



# PQIS 2013 ANNUAL REPORT

## PETROLEUM QUALITY INFORMATION SYSTEM



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## PETROLEUM QUALITY INFORMATION SYSTEM 2013 ANNUAL REPORT

DLA Energy is pleased to provide you with the 2013 edition of the "Petroleum Quality Information System (PQIS)." PQIS is an annual publication which is managed by the Quality / Technical Support office of DLA Energy. DLA Energy, in conjunction with the services, is pleased to continue providing fuel quality data for procured alternative fuels utilizing multiple processing techniques. This data, an early look at the quality of advanced alternative fuel processing techniques, represents the fuel used by the services to certify and approve their use in Military equipment. We are pleased to announce continued growth in the variety of products which are featured in this publication. This year data is provided for an additional alternative fuel Hydroprocessed Depolymerized Cellulosic Diesel, HCD76. Analysis of the following products is continued from previous years:

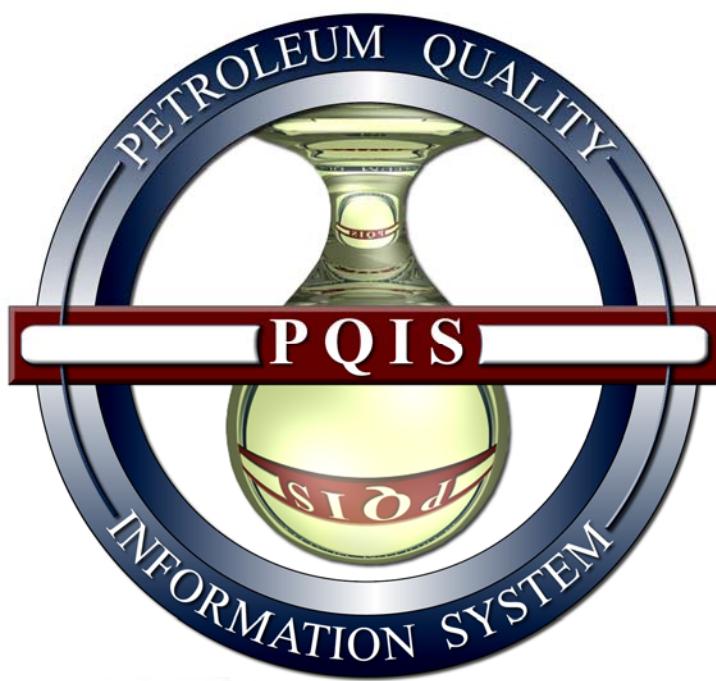
- Aviation Fuels: AN8, JAA, JA1, JP4, JP5, JP8, JPTS and TS1
- Marine Fuels: Fuel Naval Distillate (F76) and Marine Gas Oil (MGO)
- Propellants: High Density Synthetic Hydrocarbon (JP10), and Rocket Grade Kerosene (PF1 and RP1)
- Lubricants: LTL, LO6, and LA6
- Alternative Fuels: Hydroprocessed Depolymerized Cellulosic Diesel (HCD-76), Alcohol to Jet (ATJ8), and Direct Sugar to Hydrocarbon (DSH76)
- Additive: Fuel System Icing Inhibitor

We would like to thank the Quality Assurance Representatives (QARs) of DLA Energy and the representatives from the suppliers under our DLA Energy Contracts who have worked with the PQIS Team to ensure complete representation of purchased product. The result is the only worldwide comprehensive data repository of test results for refined fuel, lubricant, and fuel additive properties.

In our continued effort to provide you with reliable, accurate information, we would appreciate any feedback noting updates or suggestions on improving this book. Please contact Mr. Douglas Martin at Commercial (703) 767-8382, e-mail [douglas.martin@dla.mil](mailto:douglas.martin@dla.mil), with any questions or to obtain additional copies of this report or the CD-ROM.

PAMELA SERINO  
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# 2013 PQIS Report



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# 1. Executive Summary



# 1. Executive Summary

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# 1. Executive Summary

## Quality/Technical Support Directorate (DLA Energy–FEQ)

DLA Energy–FEQ (comprising FEQB, FEOA, and FEQC) provides quality and technical support in certification, quality assurance, and emerging research for supplying DLA Energy customers with fuel and energy-related products.



### Quality Operations Division (DLA Energy–FEOA)

DLA Energy–FEOA acts as the principal adviser and assistant to the Director for developing, monitoring, coordinating, publishing, and implementing quality policies and programs for DLA Energy–supplied commodities. It provides quality assurance (QA) and quality surveillance (QS) support to DoD and civilian agencies as defined in interservice support agreements and directives.

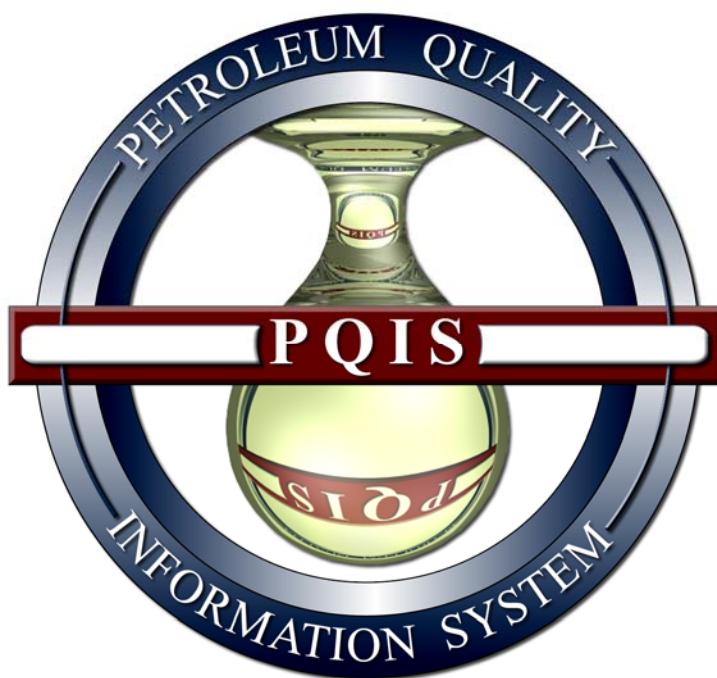
### Product Technology and Standardization Division (DLA Energy–FEQB)

DLA Energy–FEQB acts as the principal technical adviser to the Director of DLA Energy for technical matters on petroleum, missile fuels, coal, renewable and alternative fuels, and related products and services. It maintains specification and measurement contract clauses and represents DLA Energy at industry standardization groups to ensure that product specification changes do not adversely impact end-user applications. The division reviews and approves all cataloging changes for both petroleum and aerospace energy products and serves as the lead standardization activity for petroleum products in the Department of Defense (DoD). FEQB provides technical support for the introduction of new supply lines such as alternative fuels and for resolving problems in storage tanks, transportation, and handling systems caused by fuel chemistry. In addition, FEQB maintains the PQIS database.

### Quality Research Division (DLA Energy–FEQC)

DLA Energy–FEQC is the research and development (R&D) arm of DLA Energy–FEQ, which seeks out R&D solutions for renewable energy initiatives as well as alternative and synthetic fuels to meet military service needs while reducing DoD's carbon footprint. These solutions help secure installation energy, reduce petroleum need and consumption, and deliver fuel more efficiently and economically.

# 1. Executive Summary



## 2. Introduction



## 2. Introduction

### 2013 PQIS Report Information

#### Terminology

**Spectender.** A complete specification analysis report of a product being offered for acceptance by the U.S. Government. It is the written report of results for full specification testing of a designated batch of product offered for acceptance.

**Batch Analysis.** Reflects one spectender series of test results (batch), regardless of how many shipments are made from the source tank or whether more than one tank is involved in a total loading or product movement.

**Volume.** For the purposes of this report, volume is expressed in millions of U.S. gallons, unless otherwise indicated.

**Region.** A grouping of states or countries into defined geographical areas, affording a more specific or focused data analysis for a particular area of interest. It is based on the U.S. Department of Energy–designated Petroleum Administration for Defense Districts (PADDs), cited here to provide a standard industry reference for comparative study. These do not correlate with the Defense Fuel Regions or Offices. Because shipments can originate and terminate in different regions, the determination of the region is based on the refinery location, rather than on the receipt location.

**Mean.** The test result of each batch analysis added and divided by the number of batches. This average is based on occurrences of test values.

Example: Batch A, representing 1,000,000 U.S. gallons with a flash point of 46.0 °C, and Batch B, representing 500,000 U.S. gallons with a flash point of 43.5 °C.

Calculation:  $(46.0 + 43.5)/2 = \text{mean or average flash point of } 44.75 \text{ }^{\circ}\text{C.}$

**Weighted Mean.** The volumetrically weighted average, based on volumes of product represented by test values.

Example: Batch A, representing 1,000,000 U.S. gallons with a flash point of 46.0 °C, and Batch B, representing 500,000 U.S. gallons with a flash point of 43.5 °C.

Calculation:  $[(46.0 \times 1,000,000) + (43.5 \times 500,000)]/1,500,000 = (67,750,000/1,500,000) = \text{weighted mean flash point of } 45.17 \text{ }^{\circ}\text{C.}$

Note: Here, the two averaging methods differ by 0.42 °C. Each uses a different basis to calculate the average. Means are provided for each property characteristic for total product

procurements in this report. Weighted means are provided as well and are used for histograms and trends.

**NR.** Not reported or recorded. Used in charts to indicate that no value was used in that instance.

**NP.** Not procured during the reporting period.

### Data Reporting

The data presented in this report have been carefully evaluated for accuracy and completeness. A CD-ROM, which includes abridged copies of PQIS databases stripped of sensitive material, is available to all users. The results of our analyses may have been affected by data in the unabridged version, so your analyses could produce slightly different results.

Although some reporting inconsistencies are inevitable, every effort has been made for complete accountability in collecting, analyzing, and presenting the data in this report. Data shortfalls range from inapplicability because of processing or the test methods employed to exemption in particular contracts or purchase orders. Logistical and data collection challenges also affect the process. The statistics presented are carefully selected and, where possible, weighted against volumetric validations.

Only analysis data from the associated spectender (batch) are used for the completed delivery amounts received during the calendar year. When data fall short or limited procurements reduce the volume of data available, only essential data are charted in summary tables for informational purposes. For instance, see the tables provided in the Product Data section.

In the larger fuel sections included in the report (JP8, JP5, etc.), source inputs tables specify the volume of fuel and the number of reports on which a fuel characteristic was analyzed. Tables show statistical summaries of minimum, maximum, average, and volumetrically weighted means for test results by properties. When applicable, statistical summaries for test properties also are segregated by geographic source of procurement. Histograms chart the distribution of 2013 test results to the volume of fuel, except for TS1, which bases the histograms on the count of batch analyses, as volumes were not recorded for this fuel.

Note: In histograms, the far left bar represents the percent volume of fuel associated with the minimum data value. Any other bar represents the percent volume of fuel greater than the data value of the bar to the immediate left of it and up to and including the value of that bar.

## 2. Introduction

### Reporting Overview

#### Defense Fuel Region and Petroleum Administration for Defense Districts

DoD has 12 regions in the reporting structure. Regions 1 through 5—designated as PADDs—handle CONUS procurements (Figure 2-1). Regions 6 through 12 handle OCONUS procurements. Table 2-1 (page 9) lists all Defense Fuel Regions and their areas of responsibility, and Figure 2-2 (page 9) shows their locations worldwide. These regional designations are used throughout the report to identify the procurement source by geographic area and to outline CONUS and OCONUS bulk procurement acceptance responsibilities and PQIS activity processed by geographic location.

Table 2-2 (page 10) displays an 8-year breakdown by product grade by volume represented in the PQIS database. All bulk products are illustrated for 2013 by percentage of volume by fuel in Figure 2-3 (page 10). Volumes in Table 2-2 and volumes and percentages in Figure 2-3 do not represent what is procured by DLA Energy, but what is processed through the PQIS database through received test reports. Figures 2-4 and 2-5 (page 11) summarize the present and previous reporting year transportation methods used in support of the accepted procurements.

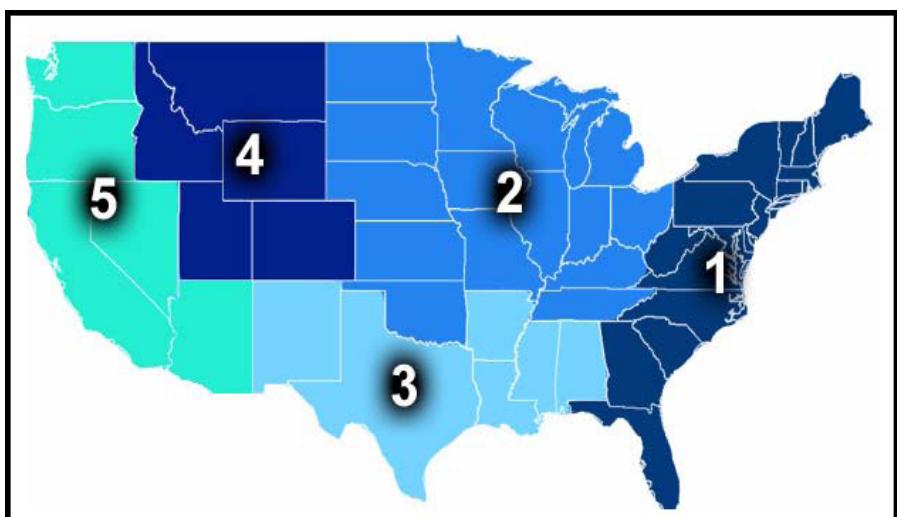


Figure 2-1: Petroleum Administration for Defense Districts

## 2. Introduction

Region	Title	PADD	State or Country
1	East Coast	I	ME, VT, NH, MA, RI, CT, NY, PA, NJ, DE, MD, VA, WV, NC, SC, GA, FL
2	East Central	II	ND, SD, MN, IA, NE, WI, MI, OH, KY, TN, IN, IL, MO, KS, OK
3	Gulf Coast	III	AL, MS, AR, LA, TX, NM
4	West Central	IV	MT, ID, WY, UT, CO
5	West Coast	V	WA, OR, CA, NV, AZ
6	Middle East		Kuwait, Bahrain, Pakistan, United Arab Emirates
7	European		Europe, Israel, Turkey
8	Pacific		Korea, Japan, HI, AK, Australia, Russia, Singapore, China
9	Caribbean		Coastal Aruba, Bermuda, Bahamas, Barbados, British Virgin Islands, Cuba, Dominican Republic, Jamaica, Grand Cayman, Martinique, Puerto Rico, Virgin Islands
10	Central & South America		Belize, Columbia, Curacao, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru
11	Canada		Canada
12	Africa		Cape Verde, Ghana

Table 2-1: Reporting Defense Regions and Areas of Responsibility



Figure 2-2: Reporting Defense Regions

## 2. Introduction

8-Year Breakdown by Product Grade by Volume (millions of gallons)								
Product	2006	2007	2008	2009	2010	2011	2012	2013
<b>AN8</b>	3.60	NR	NR	NR	4.62	NP	NP	NR
<b>JA1</b>	233.15	326.32	339.20	506.55	302.96	467.90	470.02	361.36
<b>JAA</b>	NP	NP	NP	12.01	82.50	55.11	172.90	183.35
<b>JP4</b>	0.69	1.30	0.99	0.83	1.66	0.92	1.33	0.31
<b>JP5</b>	565.17	502.26	481.92	562.86	509.01	532.06	468.27	412.50
<b>JP8</b>	2,603.10	2,286.62	2,364.57	1,968.27	1,958.43	1,839.24	1,746.03	1,096.45
<b>JPTS</b>	1.41	3.89	4.46	3.52	1.92	14.78	3.63	3.34
<b>F76</b>	539.67	565.48	597.01	514.67	507.77	610.24	500.07	430.35
<b>RME</b>	NR	NR	NR	5.12	NR	6.05	NR	13.01
<b>MGO</b>	2.19	5.53	4.45	1.39	4.88	6.71	3.27	3.15
<b>Total</b>	<b>3,948.98</b>	<b>3,691.40</b>	<b>3,792.59</b>	<b>3,575.23</b>	<b>3,373.74</b>	<b>3,533.01</b>	<b>3,365.51</b>	<b>2,503.83</b>

Table 2-2: 8-Year Breakdown by Product Grade by Volume Represented in PQIS (millions of gallons)

**Note:** Although other products were procured in 2013, such as TS1, RP1, MUM, JP10, PF1, alternative fuels, lubricants, and fuel system icing inhibitor, either volumes were not reported for these fuels or these fuels were procured in limited amounts. In such instances, products were not included in Table 2-2.

### 2013—Bulk Products Represented by Percent Volume Total 2,503.83 Million U.S. Gallons

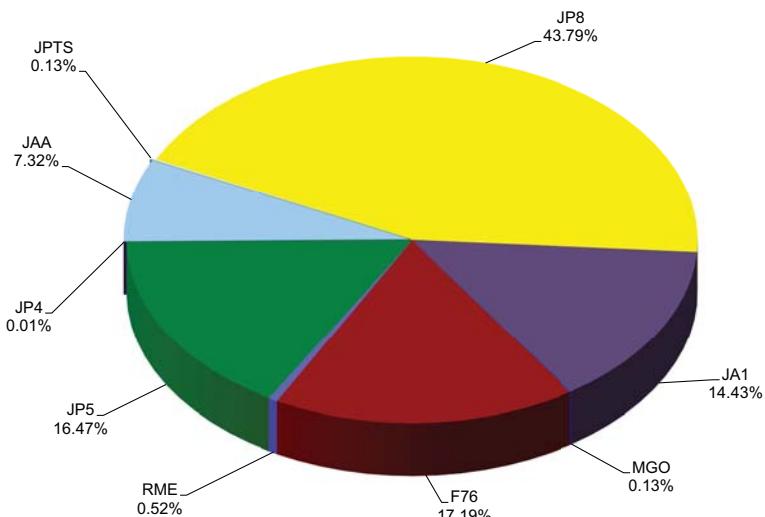


Figure 2-3: 2013 Percentage of Volume by Product Processed in PQIS

## 2. Introduction

**2013—Transportation Method by Percent Volume**  
**Total 2,500.68 Million U.S. Gallons**

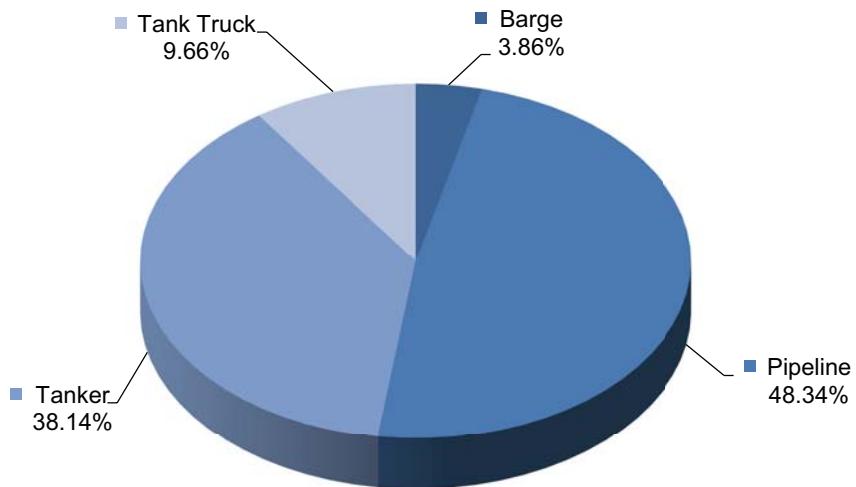


Figure 2-4: 2013 Transportation Mode by Percentage Volume

**2012—Transportation Method by Percent Volume**  
**Total 3,362.24 Million U.S. Gallons**

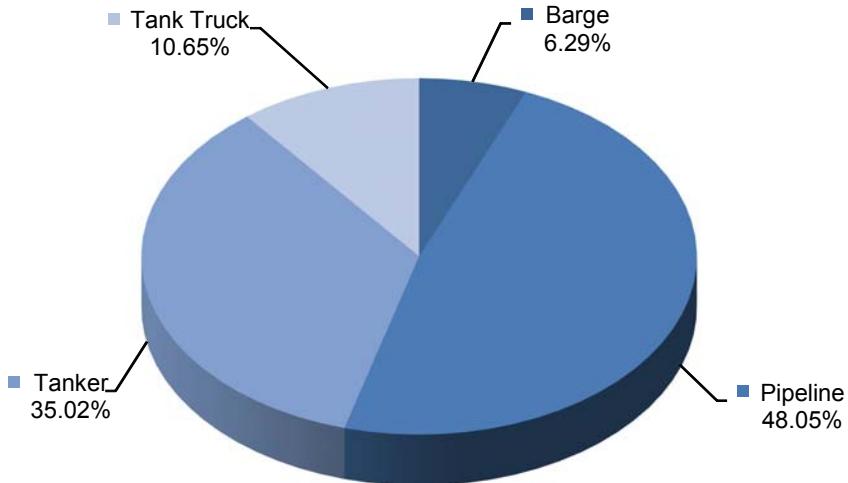


Figure 2-5: 2012 Transportation Mode by Percentage Volume

**Note:** Transportation modes are not captured for Marine Gas Oil (MGO) in the PQIS database. MGO volume totals are not included in Figures 2-4 and 2-5.

## 2. Introduction

### Summary by Region

Table 2-3 breaks down the number of analysis reports processed in the PQIS by product and individual region in 2013. Clause E40.05, Material Inspection and Receiving Report, cited in DLA Energy contracts, requires fuel contractors to submit a copy of the complete laboratory test report from each shipping tank used for shipments to DLA Energy customers. For many fuels in the product sections, source inputs tables detail the volume and number of reports used in calculating product test values. For products with limited batch reports and for region summary tables, only the total test results and volume for the product or region are provided. Analysis and volume totals are not provided for each fuel characteristic in these instances.

PQIS Batch Analysis Reports Processed by Region—2013													
Fuel	1	2	3	4	5	6	7	8	9	10	11	12	Total
JA1	—	—	—	—	—	15	89	3	—	—	—	—	107
JAA	18	22	107	56	92	—	1	—	—	—	—	—	309
JP4	—	—	—	—	—	—	—	65	—	—	—	—	65
JP5	—	—	73	—	106	—	15	14	—	—	—	—	215
JP8	7	361	320	23	169	141	8	106	—	—	—	—	1,180
JPTS	—	—	35	—	—	—	—	4	—	—	—	—	39
F76	—	—	17	—	20	26	17	9	—	—	—	—	89
MGO	37	29	1	20	—	—	—	11	23	22	—	—	143
RP1	—	—	14	—	—	—	—	—	—	—	—	—	14
TS1	—	—	—	—	—	—	—	65	—	—	—	—	65
Total	62	412	567	99	387	182	130	277	23	22	—	—	2,232

Table 2-3: 2013 Breakdown of Total Number of Analysis Reports Processed in PQIS by Product and Region

12-Year Batch Analysis Reports Processed by Region													
Year	1	2	3	4	5	6	7	8	9	10	11	12	Total
2002	113	411	1,025	193	464	95	193	290	18	—	—	—	2,802
2003	82	335	866	166	412	174	225	317	24	—	—	—	2,601
2004	6	486	1,121	152	525	195	229	296	14	—	—	—	3,024
2005	131	316	1,200	172	444	195	194	264	53	49	4	2	3,024
2006	18	301	1,111	147	436	261	122	415	43	11	1	—	2,866
2007	118	265	800	131	413	286	138	336	26	26	—	1	2,540
2008	77	315	934	130	426	292	180	327	41	23	2	4	2,751
2009	31	353	922	129	337	121	116	220	7	5	1	—	2,242
2010	52	344	918	134	363	106	117	433	35	50	3	3	2,558
2011	76	379	837	94	416	134	316	382	15	38	1	—	2,689
2012	48	358	750	136	321	116	198	439	24	36	—	—	2,428
2013	62	412	571	99	387	182	132	277	23	22	—	—	2,232

Table 2-4: 12-Year Batch Analysis Reports Processed by Region

**Note:** The region was not recorded for several JAA, JP5, and JP8 samples in 2013. Consistent with previous years, analysis reports without a region assigned are still included in the 2013 Total column in Table 2-3.

## 2. Introduction

The values in Table 2-4 represent the PQIS availability of possible spectender analysis reports for individual batches processed by region for calendar years 2002–2013.

Table 2-5 shows a 3-year history of volume by product by region processed in the PQIS.

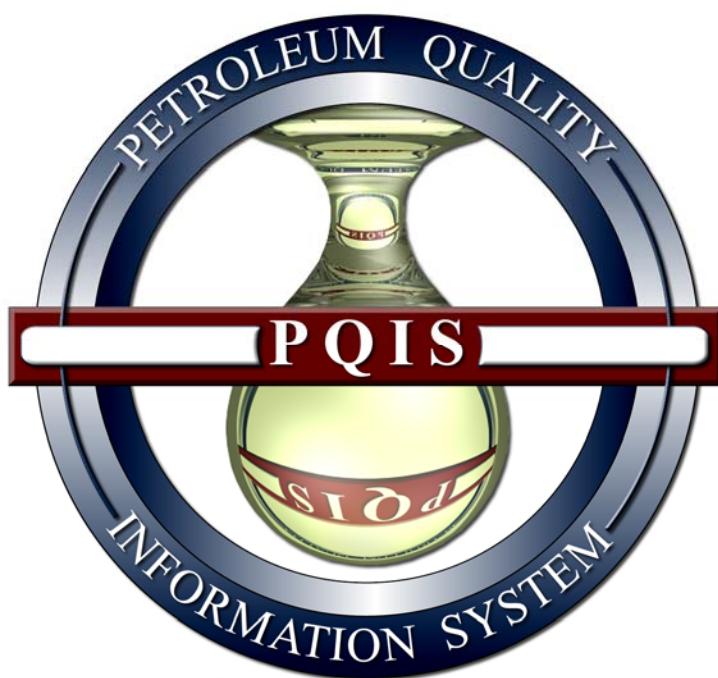
Although other products were procured in 2013, such as TS1, RP1, MUM, JP10, PF1, alternative fuels, lubricants, and fuel system icing inhibitor, volumes either were not reported for these fuels or these products were procured in limited amounts. For these reasons, all products are not included in Table 2-5.

PQIS Annual Volume by Product by Region, 2011–2013 (millions of gallons)														
Year	Fuel	1	2	3	4	5	6	7	8	9	10	11	12	Total
2011	JA1	—	—	—	—	—	210.36	257.54	NR	—	—	—	—	467.90
	JAA	NR	3.09	18.49	—	33.63	—	—	—	—	—	—	—	55.20
	JP4	—	—	—	—	—	—	—	0.93	—	—	—	—	0.93
	JP5	—	0.48	235.85	—	99.90	73.87	62.38	56.64	—	—	—	—	529.12
	JP8	8.11	228.70	692.81	47.23	312.52	189.09	201.91	145.88	—	—	—	—	1,826.26
	JPTS	—	—	4.28	—	—	—	—	NR	—	—	—	—	4.28
	F76	—	—	100.16	—	83.86	65.14	111.10	238.20	—	—	—	—	598.46
	MGO	0.86	0.62	0.04	—	0.54	—	—	2.76	0.34	1.53	0.02	—	6.71
2012	JA1	—	—	—	—	—	192.55	190.96	63.57	—	—	—	—	447.07
	JAA	13.34	24.27	67.92	4.03	44.53	—	—	—	—	—	—	—	154.09
	JP4	—	—	—	—	—	—	—	1.83	—	—	—	—	1.83
	JP5	—	—	234.76	—	106.52	—	24.07	53.15	—	—	—	—	418.50
	JP8	11.59	193.48	675.20	77.55	325.83	152.78	74.04	213.01	—	—	—	—	1,723.48
	JPTS	—	—	3.49	—	—	—	—	NR	—	—	—	—	3.49
	F76	—	—	129.28	—	50.42	129.73	40.37	157.24	NR	—	—	—	507.04
	MGO	0.53	0.28	0.03	—	0.34	—	—	0.69	0.22	1.17	—	—	3.27
2013	JA1	—	—	—	—	—	100.13	167.47	20.17	—	—	—	—	287.76
	JAA	40.59	2.03	62.82	11.69	32.87	—	NR	—	—	—	—	—	150.00
	JP4	—	—	—	—	—	—	—	0.30	—	—	—	—	0.30
	JP5	—	—	212.50	—	66.78	—	31.45	48.59	—	—	—	—	359.32
	JP8	12.42	185.84	467.90	15.05	99.13	85.15	32.33	167.02	—	—	—	—	1,064.83
	JPTS	—	—	3.22	—	—	—	—	NR	—	—	—	—	3.22
	F76	—	—	67.37	—	53.31	200.02	50.62	46.34	—	—	—	—	417.66
	MGO	0.69	0.57	0.02	—	0.53	—	—	0.50	0.27	0.47	—	—	3.05

Table 2-5: Annual Volume of Fuel Processed by Product by Region in PQIS, 2011–2013 (millions of gallons)

**Note:** JAA, JP5, and JP8 batch analysis reports with no region assigned also had no volume entered, so these samples do not impact the total volumes for these products in Table 2-5. The region was not recorded for one MGO sample in 2011, but the volume for this sample is still included in the 2011 total volume for MGO in Table 2-5.

## 2. Introduction



### 3. Product Data



### 3. Product Data

#### Product Specifications

The following products are represented in PQIS:

**AN8.** MIL-DTL-83133 Clause Turbine Fuel, Aviation, AN8

**ATJ8.** Neat Alcohol-to-Jet Fuel

**DSH76.** Direct Sugar to Hydrocarbon Conversion

**F76.** MIL-DTL-16884 Fuel, Naval Distillate, DFM/NATO Code F-76

**FSII.** MIL-DTL-85470, Inhibitor, Icing, Fuel System, High Flash NATO Code S-1745

**HDCD76.** Hydroprocessed Depolymerized Cellulosic Diesel

**JA1.** Turbine Fuel, Aviation, Defence Standard 91-91

**JAA.** Jet A Turbine Fuel, Aviation, ASTM D 1655 (F-24)

**JP4.** MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP4, NATO Code F-40

**JP5.** MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5, NATO Code F-44

**JP8.** MIL-DTL-83133 Turbine Fuel, Aviation, JP8, NATO Code F-34

**JP10.** MIL-DTL-87107 Propellant, High Density Synthetic Hydrocarbon Type, Grade JP-10

**JPTS.** MIL-DTL-25524 (USAF) Turbine Fuel, Aviation, Thermally Stable

**LA6.** MIL-PRF-6081, Lubricating Oil, Jet Engine, Grade 1010

**LO6.** MIL-PRF-009000, Lubricating Oil, Shipboard Internal Combustion Engine, High-Output Diesel

**LTL.** MIL-PRF-17331, Lubricating Oil, Steam Turbine and Gear, Moderate Service

**MGO.** ISO-8217, Marine Gas Oil, Grade DMA

**PF1.** MIL-DTL-87173 (USAF) Propellant, Priming Fluid, ALCM Engine, Grade PF-1

**RME180.** ISO-8217, Marine Residual Fuel, Grade RME-180

**RP1.** MIL-DTL-25576 Propellant, Rocket Grade Kerosene, Grade RP-1

**TS1.** GOST 10227-86, Russian Jet Fuel, Grade TC-1, First Category of Quality

### 3. Product Data

The specifications for these products govern the composition of the fuels procured for DoD. In most tables, this report summarizes only specification properties that have measurable and definitive requirements in the specification. Exceptions include Cetane index (report) and water content for JP8.

Select values for properties and characteristics are reported where data were recorded in PQIS but not required by specification—for example, various distillation ranges. In most instances, specification properties that involve an assigned rating are not summarized. Data for properties not reported are available on request from DLA Energy—FEQB.

Various options may apply to product testing, and not all tests are performed on each batch equally for the purpose of data extraction and comparative analysis—for example, the net heat of combustion requirement. Contractors have a choice of test methods or units of measurement for reporting. In the case of performing mercaptan sulfur testing, if the doctor test is negative, a mercaptan test need not be performed. Reporting of mercaptan sulfur results is not consistent with the number of batches. Many providers perform and report both results. In such instances, on the basis of these variables, the number of results selected from the total available analysis by batch may differ for individual test parameters for a given product.

The volume of fuel and number of analyses used to determine each histogram are included in the source inputs table at the beginning of each product data section. Specification criteria are listed in all test results tables and histograms.

When limited procurements do not support a comprehensive review of a particular fuel, data are presented in a pair of tables, noting the region, volume of fuel, number of batch analyses, minimum value, maximum value, mean, and weighted mean. JAA, JP4, and JPTS are reported for 2013 in this manner. Data for propellants (RP1), alternative fuels (DSH76), lubricants (LTL, LO6, and LA6), and FSII are summarized in a single table displaying the minimum value, maximum value, and mean for fuel characteristics. Weighted means also are provided for lubricants and FSII, as volumes were reported for these products.

### 3. Product Data

#### JAA—2013 Data Summary

Tables 3-1 and 3-2 display JAA results for the 2013 reporting period, during which Regions 1, 2, 3, 4, 5, and 7 processed JAA batch analysis reports in the PQIS. In 2013, 309 analyses were queried from the PQIS, representing 150.00 million U.S. gallons. All batches met specification requirements for all fuel properties measured in 2013.

For JAA, when the smoke point result is below 25 mm, the product is acceptable so long as the naphthalene content is below

Jet A Turbine Fuel, Aviation, ASTM D 1655 (JAA)			
Property	2013 Source Inputs		
	Region	Volume	Analysis
<b>Total Acid Number:</b> (mg KOH/g)	All	136.24	300
<b>Aromatics:</b> (vol %)	All	136.24	299
<b>Sulfur Mercaptan:</b> (mass %)	All	9.46	49
<b>Sulfur, Total:</b> (mass %)	All	137.11	299
<b>Distillation:</b>			
Initial Boiling Point (IBP) (°C)	All	9.46	6
10% Recovered, (°C)	All	150.00	308
50% Recovered, (°C)	All	150.00	308
90% Recovered, (°C)	All	150.00	308
Final Boiling Point (FBP), (°C)	All	150.00	308
Residue, (vol %)	All	144.97	306
Loss, (vol %)	All	144.97	306
<b>Flash Point:</b> (°C)	All	146.29	298
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	All	106.52	158
<b>Freezing Point:</b> (°C)	All	150.00	308
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)	All	136.91	296
<b>Net Heat of Combustion:</b> (MJ/kg)	All	137.11	300
<b>Smoke Point:</b> (mm)	All	137.11	301
<b>Naphthalene:</b> (vol %)	All	120.05	246
<b>Thermal Stability:</b>			
Change in pressure drop, (mm Hg @ 275 °C)	All	NR	NR
Change in pressure drop, (mm Hg @ 260 °C)	All	137.11	301
<b>Existent Gum:</b> (mg/100 mL)	All	137.11	301
<b>Water Separation Characteristics:</b> (rating)	All	149.75	307

Table 3-1: Jet A Turbine Fuel, Aviation, ASTM D 1655 (JAA), 2013 Source Inputs (volume in millions of gallons)

### 3. Product Data

3.0 percent and the smoke point is equal to or greater than the minimum of 18 mm. All 2013 naphthalene values are below 3.0 percent, and all smoke point values are equal to or greater than 18 mm so all smoke point values for 2013 are acceptable.

For JAA, the water separation characteristics rating is a minimum of 85 with no electrical conductivity additive and a minimum of 70 with an electrical conductivity additive.

Jet A Turbine Fuel, Aviation, ASTM D 1655 (JAA)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.10</b>	0.0000	0.1000	0.0045	0.0062
<b>Aromatics:</b> (vol %)		<b>25.0</b>	8.40	23.10	16.25	16.76
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.003</b>	0.0000	0.0020	0.0011	NR
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0000	0.2690	0.0657	0.0600
<b>Distillation:</b>						
Initial Boiling Point (IBP) (°C)		Report	159.9	163.3	162.0	161.5
10% Recovered, <sup>1</sup> (°C)		205 <sup>(185)</sup>	125.6	197.7	174.2	177.5
50% Recovered, (°C)		Report	184.0	222.2	201.2	203.7
90% Recovered, (°C)		Report	209.7	258.8	239.6	240.6
Final Boiling Point (FBP), <sup>1</sup> (°C)		300 <sup>(340)</sup>	224.5	292.1	265.1	264.4
Residue, (vol %)		1.5	0.00	1.50	1.01	1.01
Loss, (vol %)		1.5	0.00	1.50	0.78	0.85
<b>Flash Point:</b> (°C)	<b>38</b>		39.0	63.0	46.58	48.83
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7825	0.8290	0.8042	0.8048
<b>Freezing Point:</b> (°C)		<b>-40</b>	-60.6	-41.0	-51.5	-49.7
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	2.900	7.190	4.426	4.633
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.000	43.600	43.263	43.246
<b>Smoke Point:</b> (mm)	<b>25.0</b>		18.0	30.0	23.22	23.43
<b>Naphthalene:</b> (vol %)		<b>3.0</b>	0.20	2.71	1.36	1.39
<b>Thermal Stability:</b>						
Change in pressure drop, (mm Hg @ 275 °C)		NR	NR	NR	NR	NR
Change in pressure drop, (mm Hg @ 260 °C)		25	0.00	24.00	0.56	0.51
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.00	5.00	0.99	1.18
<b>Water Separation Characteristics:</b> (rating)	<b>70</b>		73	100	95.3	94.4

Table 3-2: Jet A Turbine Fuel, Aviation, ASTM D 1655 (JAA), 2013 Test Results

**Note 1:** Test method D2887 limits in parentheses (°C).

**Note 2:** Some values obtained for sulfur, total are below the test method detection limits.

### 3. Product Data

#### JP4—2013 Data Summary

Tables 3-3 and 3-4 display JP4 results for the 2013 reporting period, during which only Region 8 processed JP4 batch analysis reports in the PQIS. Sixty-five analyses were queried from the PQIS, representing 303.74 thousand U.S. gallons. Aside from 11 hydrogen content values falling below the minimum specification limit, all batches met specification requirements for 2013. Three test results were below the minimum specification limit for "Distillation, 50% Recovered," but a waiver was granted allow-

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP4 (NATO F-40)			
Property	2013 Source Inputs		
	Region	Volume	Analysis
<b>Total Acid Number:</b> (mg KOH/g)	8	0.30	65
<b>Aromatics:</b> (vol %)	8	0.30	58
<b>Sulfur, Mercaptan:</b> (mass %)	8	0.30	64
<b>Sulfur, Total:</b> (mass %)	8	0.30	65
<b>Distillation:</b>			
Initial Boiling Point (IBP) (°C)	8	0.30	65
10% Recovered, (°C)	8	0.30	65
20% Recovered, (°C)	8	0.30	65
50% Recovered, (°C)	8	0.30	65
90% Recovered, (°C)	8	0.30	65
End Point, (°C)	8	0.30	65
Residue, (vol %)	8	0.30	65
Loss, (vol %)	8	0.30	65
<b>Density:</b> (API @ 15 °C)	8	0.30	61
<b>Density:</b> (kg/L @ 15 °C)	8	0.30	65
<b>Vapor Pressure:</b> (kPa @ 37.8°C)	8	0.27	32
<b>Freezing Point:</b> (°C)	8	0.30	65
<b>Heating Value, Heat of Combustion:</b> (MJ/kg)	8	0.30	65
<b>Hydrogen Content:</b> (mass %)	8	0.30	39
<b>Smoke Point:</b> (mm)	8	NR	NR
<b>Thermal Stability:</b>			
Change in pressure drop, (mm Hg @ 275 °C)	8	NR	NR
Change in pressure drop, (mm Hg @ 260 °C)	8	0.30	65
<b>Existent Gum:</b> (mg/100 mL)	8	0.30	61
<b>Particulate Matter:</b> (mg/L)	8	0.30	65
<b>Filtration Time:</b> (minutes)	8	0.30	65
<b>Micro Separometer (MSEP):</b> (rating)	8	0.30	65
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	8	0.30	65
<b>Fuel Electrical Conductivity:</b> (pS/m)	8	0.30	64

Table 3-3: MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP4 (NATO F-40), 2013 Source Inputs (volume in millions of gallons)

### 3. Product Data

ing JP4 to be produced to an older version of the specification. All values were within the limits allowed by the waiver.

The specification criterion listed for Micro Separometer (MSEP) is presented as the lowest acceptable by specification. The threshold lower limit on MSEP ratings varies from 70 to 90 on the basis of additives and additive combinations.

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP4 (NATO F-40)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.004	0.015	0.007	0.008
<b>Aromatics:</b> (vol %)		<b>25.0</b>	14.1	18.6	16.03	16.36
<b>Sulfur, Mercaptan:</b> (mass %)		<b>0.002</b>	0.0004	0.0060	0.0007	0.0007
<b>Sulfur, Total:</b> (mass %)		<b>0.40</b>	0.010	0.019	0.013	0.013
<b>Distillation:</b>						
Initial Boiling Point (IBP) (°C)		Report	24.6	67.2	48.7	46.6
10% Recovered, (°C)		Report	112.3	116.0	114.3	114.8
20% Recovered, (°C)	100		117.5	121.1	119.0	119.5
50% Recovered, (°C)	125		120.8	128.7	126.6	126.8
90% Recovered, (°C)		Report	138.9	144.7	141.6	142.8
End Point, (°C)		270	170.9	222.8	186.2	191.9
Residue, (vol %)		1.5	0.5	1.5	1.21	1.25
Loss, (vol %)		1.5	0.0	1.5	1.07	0.97
<b>Density:</b> (API @ 15 °C)	<b>45.0</b>	<b>57.0</b>	52.7	53.3	52.99	52.92
<b>Density:</b> (kg/L @ 15 °C)	<b>0.751</b>	<b>0.802</b>	0.7657	0.7878	0.7683	0.7699
<b>Vapor Pressure:</b> (kPa @ 37.8°C)	<b>14</b>	<b>21</b>	16.30	17.80	17.12	17.48
<b>Freezing Point:</b> (°C)		-58	-80.5	-58.0	-76.2	-76.1
<b>Heating Value, Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.1	43.3	43.22	43.21
<b>Hydrogen Content:</b> (mass %)	<b>13.5</b>		13.30	13.60	13.47	13.48
<b>Smoke Point:</b> (mm)	<b>20.0</b>		NR	NR	NR	NR
<b>Thermal Stability:</b>						
Change in pressure drop, (mm Hg @ 275 °C)		25	NR	NR	NR	NR
Change in pressure drop, (mm Hg @ 260 °C)			0.00	5.00	1.49	0.28
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	1.00	2.00	1.10	1.03
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.05	0.74	0.40	0.44
<b>Filtration Time:</b> (minutes)		<b>10</b>	3	5	3.06	3.19
<b>Micro Separometer (MSEP):</b> (rating)	<b>70</b>		94	100	98.2	96.5
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.10</b>	<b>0.15</b>	0.11	0.14	0.132	0.133
<b>Fuel Electrical Conductivity:</b> (pS/m)	<b>150</b>	<b>600</b>	163.0	575.0	298.4	395.2

Table 3-4: MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP4 (NATO F-40), 2013 Test Results

### 3. Product Data

#### JPTS—2013 Data Summary

Tables 3-5 and 3-6 display JPTS results for the 2013 reporting period. Thirty-nine analyses were queried from the PQIS, representing 3.22 million U.S. gallons. Regions 3 and 8 processed JPTS batch analysis reports for this reporting period, but volumes were only recorded for Region 3. All batches met specification requirements for all fuel properties measured in 2013.

MIL-DTL-25524 (USAF) Turbine Fuel, Aviation, Thermally Stable			
Property	2013 Source Inputs		
	Region	Volume	Analysis
<b>Total Acid Number:</b> (mg KOH/g)	All	3.22	38
<b>Aromatics:</b> (vol %)	All	3.22	38
<b>Sulfur, Mercaptan:</b> (mass %)	All	NR	NR
<b>Sulfur, Total:</b> (mass %)	All	3.22	38
<b>Distillation:</b>			
Initial Boiling Point (IBP) (°C)	All	3.12	37
10% Recovered, (°C)	All	3.22	38
50% Recovered, (°C)	All	3.22	38
90% Recovered, (°C)	All	3.22	38
End Point, (°C)	All	3.22	38
Residue, (vol %)	All	3.22	38
Loss, (vol %)	All	3.22	38
<b>Flash Point:</b> (°C)	All	3.22	38
<b>Density:</b> (API @ 60 °F)	All	3.17	37
<b>Freezing Point:</b> (°C)	All	3.12	37
<b>Viscosity:</b> (cSt @ -40 °C)	All	3.22	38
<b>Net Heat of Combustion:</b> (BTU/lb)	All	2.26	27
<b>Hydrogen Content:</b> (mass %)	All	3.22	38
<b>Smoke Point:</b> (mm)	All	3.22	38
<b>Thermal Stability:</b>			
Change in pressure drop, (mm Hg @ 335 °C)	All	0.81	12
<b>Existent Gum:</b> (mg/100 mL)	All	3.12	37
<b>Particulate Matter:</b> (mg/L)	All	3.14	37
<b>Water Separation Characteristics:</b> (rating)	All	3.22	38

Table 3-5: MIL-DTL-25524 (USAF) Turbine Fuel, Aviation, JPTS, 2013 Source Inputs (volume in millions of gallons)

### 3. Product Data

For JPTS, a hydrogen content minimum of 14.00 or a smoke point minimum of 25 mm is acceptable. The sulfur, mercaptan limit or a negative doctor test result is acceptable to meet the specification requirement. For distillation values, test method D2887 limits are in parentheses under the specification limits columns in Table 3-6.

MIL-DTL-25524 (USAF) Turbine Fuel, Aviation, Thermally Stable						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0020	0.0120	0.0050	0.0050
<b>Aromatics:</b> (vol %)	<b>5.0</b>	<b>20.0</b>	9.0	15.5	12.11	12.31
<b>Sulfur, Mercaptan:</b> (mass %)		<b>0.001</b>	NR	NR	NR	NR
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0001	0.0070	0.0034	0.0037
<b>Distillation</b> (D2887 limits in parentheses):						
Initial Boiling Point (IBP), <sup>1</sup> (°C)	157 <sup>(105)</sup>		157.0	169.0	161.5	161.9
10% Recovered, <sup>1</sup> (°C)		193 <sup>(174)</sup>	162.9	175.0	170.0	170.5
50% Recovered, <sup>1</sup> (°C)		204 <sup>(207)</sup>	173.3	195.0	184.7	185.5
90% Recovered, <sup>1</sup> (°C)		238 <sup>(250)</sup>	207.3	229.0	217.4	218.3
End Point, <sup>1</sup> (°C)		260 <sup>(288)</sup>	222.3	255.0	237.8	239.2
Residue, (vol %)		1.5	0.0	1.5	0.87	0.85
Loss, (vol %)		1.5	0.0	1.1	0.21	0.19
<b>Flash Point:</b> (°C)	<b>43</b>		45.0	54.0	49.32	49.61
<b>Density:</b> (API @ 60 °F)	<b>46.0</b>	<b>53.0</b>	47.1	51.2	50.1	50.4
<b>Freezing Point:</b> (°C)		<b>-53</b>	-62.4	-53.3	-57.9	-57.7
<b>Viscosity:</b> (cSt @ -40 °C)		<b>12.0</b>	3.10	6.90	6.05	6.12
<b>Net Heat of Combustion:</b> (BTU/lb)	<b>18,400</b>		18,653	18,745	18,718	18,726
<b>Hydrogen Content:</b> (mass %)	<b>14.00</b>		14.04	14.43	14.30	14.32
<b>Smoke Point:</b> (mm)	<b>25.0</b>		26.0	27.0	26.58	26.63
<b>Thermal Stability:</b>						
Change in pressure drop, (mm Hg @ 335°C)		<b>25</b>	0.00	7.50	2.06	2.27
<b>Existent Gum:</b> (mg/100 mL)		<b>5.0</b>	0.16	2.40	0.72	0.71
<b>Particulate Matter:</b> (mg/L)		<b>0.3</b>	0.02	0.30	0.15	0.15
<b>Water Separation Characteristics:</b> (rating)	<b>Report</b>		70	97	86.5	87.0

Table 3-6: MIL-DTL-25524 (USAF) Turbine Fuel, Aviation, JPTS, 2013 Test Results

**Note 1:** Test method D2887 limits in parentheses (°C).

### 3. Product Data

#### AN8—2013 Data Summary

Table 3-7 displays AN8 results for the 2013 reporting period. One analysis was queried from the PQIS, but the volume was not recorded. Region 7 processed the AN8 batch analysis report for this reporting period. All batches met specification requirements for all fuel properties measured in 2013.

MIL-DTL-83133 Clause Turbine Fuel, Aviation (AN8)			
Property	Specification Limits		2013 Test Results
	Min	Max	
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.007
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.3
<b>Sulfur Mercaptan:</b> <sup>1</sup> (mass %)		<b>0.002</b>	0.0010
<b>Sulfur, Total:</b> (mass %)		<b>0.0015</b>	0.00042
<b>Distillation:</b>			
Initial Boiling Point (IBP), (°C)		<b>Report</b>	150.0
10% Recovered, (°C)		<b>205</b>	165.0
20% Recovered, (°C)		<b>Report</b>	169.0
50% Recovered, (°C)		<b>Report</b>	184.0
90% Recovered, (°C)		<b>Report</b>	214.0
Final Boiling Point (FBP), (°C)		<b>300</b>	233.0
Residue, (vol %)		<b>1.5</b>	1.10
Loss, (vol %)		<b>1.5</b>	0.50
<b>Flash Point:</b> (°C)	<b>38</b>		44.0
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7869
<b>Freezing Point:</b> (°C)		<b>-58</b>	-62.0
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	3.279
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.390
<b>Smoke Point:</b> <sup>2</sup> (mm)	<b>25.0</b>		25.0
<b>Thermal Stability:</b>			
Change in pressure drop, mm Hg @ 260 °C		<b>25</b>	0.00
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	2.00
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.60
<b>Filtration Time:</b> (minutes)		<b>15</b>	4
<b>Water Separation Index:</b> (rating)	<b>70</b>		95

Table 3-7: MIL-DTL-83133 Clause Turbine Fuel, Aviation, AN8, 2013 Test Results

**Note 1:** Either the sulfur mercaptan limit or a negative doctor test result is acceptable to meet the specification requirement.

**Note 2:** When the smoke point result is below 25 mm, the product is acceptable so long as the naphthalene content is below 3.0 percent and the smoke point is above the minimum of 19 mm. Waivers were granted for the smoke point values below 19 mm.

### 3. Product Data

#### JP10—2013 Data Summary

Table 3-8 displays JP10 results for the 2013 reporting period, during which only Region 3 processed JP10 batch analysis reports. Three analyses were queried from the PQIS, but volumes were not recorded. All batches met specification requirements for all fuel properties measured in 2013.

MIL-DTL-87107, Propellant, High Density Synthetic Hydrocarbon Type, Grade JP-10					
Property	Specification Limits		2013 Test Results		
	Min	Max	Min	Max	Mean
<b>Color, Saybolt:</b>	+25		30	30	30
<b>Chemical Analysis:</b>					
Exo-tetrahydrodicyclopentadiene: (wt %)	98.5	100.0	99.5	99.6	99.53
Other Hydrocarbons: (wt %)		1.5	0.4	0.5	0.47
<b>Flash Point:</b> (°C)	54.4		55.00	60.00	57.00
<b>Density:</b> (kg/L @ 15 °C)	0.934	0.943	0.939	0.940	0.940
<b>Freezing Point:</b> (°C)	Report		-80.0	-80.0	-80.0
<b>Viscosity:</b>					
mm <sup>2</sup> /s @ -54 °C		40	29.00	32.00	30.67
mm <sup>2</sup> /s @ -18 °C		10	7.00	8.00	7.33
<b>Net Heat of Combustion:</b>					
MJ/kg	42.1		42.1	42.2	42.15
MJ/m	39,400		39,726	39,726	39,726
<b>Thermal Stability:</b>					
Change in pressure drop, (mm Hg @ 300 °C)		10	0.0	0.0	0.0
Heater tube deposit visual rating		< code 3	1	1	1
<b>Existent Gum:</b> (mg/100 mL)		5.0	1.0	1.0	1.0
<b>Particulate Matter:</b> (mg/L)		1.0	0.0	0.4	0.13

Table 3-8: MIL-DTL-87107, Propellant, High Density Synthetic Hydrocarbon Type, Grade JP-10, 2013 Test Results

### 3. Product Data

#### PF1—2013 Data Summary

Table 3-9 displays PF1 results for the 2013 reporting period. One analysis was queried from the PQIS, but the volume was not recorded. Region 3 processed the PF1 batch analysis report for this reporting period. All batches met specification requirements for all fuel properties measured in 2013.

MIL-DTL-87173 (USAF), Propellant, Priming Fluid, ALCM Engine, Grade PF-1			
Property	Specification Limits		2013 Test Results
	Min	Max	
<b>Color, Saybolt</b>	<b>+25</b>		29
<b>Chemical Composition:</b>			
Methylcyclohexane: (wt %)	<b>10.0</b>	<b>15.0</b>	12.50
Exotetraydrodi (cyclopentadiene): (wt %)	<b>83.5</b>	<b>90.0</b>	87.20
Other Hydrocarbons: (wt %)		<b>1.5</b>	NR
<b>Flash Point: (°C)</b>	<b>16</b>	<b>27</b>	25.0
<b>Specific Gravity:</b> (kg/L @ 15 °C)	<b>0.900</b>	<b>0.930</b>	0.916
<b>Freezing Point: (°C)</b>		<b>-54</b>	-80.0
<b>Viscosity:</b> (cSt @ -54 °C)		<b>40</b>	34.0
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.1</b>		42.4
<b>Thermal stability:</b>			
Change in pressure drop, mm Hg @ 300 °C		<b>10</b>	0.0
Heater tube deposit visual rating		< code 3	1
<b>Existent Gum:</b> (mg/100 mL)		<b>5.0</b>	1.0
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	1.0
<b>Fuel System Icing Inhibitor:</b> (vol %)	<b>0.10</b>	<b>0.15</b>	NR

Table 3-9: MIL-DTL-87173 (USAF), Propellant, Priming Fluid, ALCM Engine, Grade PF-1, 2013 Test Results

## RP1—2013 Data Summary

Table 3-10 displays RP1 results for the 2013 reporting period, during which only Region 3 processed RP1 batch analysis reports. Fourteen analyses were queried from the PQIS, but volumes were not recorded. All batches met specification requirements for all fuel properties measured in 2013.

MIL-DTL-25576, Propellant, Rocket Grade Kerosene, Grade RP-1					
Property	Specification Limits		2013 Test Results		
	Min	Max	Min	Max	Mean
<b>Aromatics:</b> (vol %)		<b>5.0</b>	5.0	5.0	5.0
<b>Mercaptan-sulfur:</b> (mg/kg)		<b>3</b>	3.0	3.0	3.0
<b>Sulfur, Total:</b> (mg/kg)		<b>30</b>	1.0	1.0	1.0
<b>Specific Gravity:</b> (kg/L @ 15 °C)	<b>0.799</b>	<b>0.815</b>	0.8000	0.8110	0.8014
<b>Distillation:</b>					
Initial Boiling Point (IBP) (°F)	<b>Report</b>		359.0	368.0	363.6
Fuel Evaporated, 10%, (°F)	<b>365</b>	<b>410</b>	383.0	387.0	385.2
Fuel Evaporated, 50%, (°F)	<b>Report</b>		412.0	417.0	414.1
Fuel Evaporated, 90%, (°F)	<b>Report</b>		462.0	471.0	465.5
End Point, (°F)		<b>525</b>	495.0	505.0	499.8
Residue, (vol %)		<b>1.5</b>	1.2	1.2	1.2
Loss, (vol %)		<b>1.5</b>	0.3	1.1	0.7
<b>Flash Point:</b> (°F)	<b>140</b>		151.0	158.0	154.5
<b>Hydrogen Content:</b> (mass %)	<b>13.8</b>		14.20	14.30	14.29
<b>Freezing Point:</b> (°F)		<b>-60</b>	-107.0	-80.0	-98.4
<b>Viscosity:</b> (cSt @ -30 °F)		<b>16.5</b>	7.100	10.500	8.729
<b>Thermal Value, Net Heat of Combustion:</b> (BTU/lb)	<b>18,500</b>		18,577	18,727	18,668
<b>Particulate:</b> (mg/L)		<b>1.0</b>	0.00	0.10	0.04
<b>Olefins:</b> (vol %)		<b>2.0</b>	0.30	0.90	0.53
<b>Existent Gum:</b> (mg/100 mL)		<b>1</b>	1.00	1.00	1.00
<b>Copper Strip Corrosion</b>		<b>1</b>	1	1	1

Table 3-10: MIL-DTL-25576, Propellant, Rocket Grade Kerosene, Grade RP-1, 2013 Test Results

### 3. Product Data

#### ATJ8—2013 Data Summary

Table 3-11 displays Neat Alcohol-to-Jet (ATJ8) results for the 2013 reporting period. Five analyses were queried from the PQIS, but volumes were not recorded. Of the five analyses, three included density measurements, all of which fell below the minimum specification limit. Aside from the density measurements, all batches met specification requirements for all fuel properties measured in 2013.

Neat Alcohol-to-Jet (ATJ8) Fuel					
Property	Specification Limits		2013 Test Results		
	Min	Max	Min	Max	Mean
Water: (mg/kg)		75	4	58	25.3
Total Acid Number: (mg KOH/g)		0.015	0.000	0.007	0.0024
Distillation					
Initial Boiling Point, (°C)		Report	167.0	171.6	169.7
10% Recovered, (°C)		205	175.6	177.8	176.6
50% Recovered, (°C)		Report	179.9	187.0	182.7
90% Recovered, (°C)		Report	215.1	247.0	229.4
Final Boiling Point, (°C)		300	252.9	278.0	263.2
T90-T10, (°C)	22		46.1	77.3	54.6
Flash Point: (°C)	38		46.1	52.0	48.1
Density: (kg/L @ 15 °C)	0.751	0.840	0.631	0.639	0.635
Thermal Stability:					
Change in pressure drop, mm Hg @ 325 °C		25	0.00	3.00	1.20
Heater tube deposit, visual rating		<3	0	1	0.8

Table 3-11: Neat Alcohol-to-Jet (ATJ8), 2013 Test Results

## DSH76—2013 Data Summary

Table 3-12 displays Direct Sugar to Hydrocarbon Conversion (DSH76) results for the 2013 reporting period. One analysis was queried from the PQIS, but the volume was not recorded. All batches met specification requirements for all fuel properties measured in 2013.

Direct Sugar to Hydrocarbon Conversion (DSH76)			
Property	Specification Limits		2013 Test Result
	Min	Max	
<b>Flash Point:</b> (°C)	<b>60</b>		109
<b>Density:</b> (kg/L @ 15 °C)	<b>0.772</b>	<b>0.800</b>	0.7735
<b>Total Water:</b> (ppm)		<b>200</b>	8
<b>Particulate:</b> (mg/L)		<b>1.0</b>	0.50
<b>Kinematic Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	<b>1.7</b>	<b>4.3</b>	2.398
<b>Cetane Number:</b> (calculated)	<b>42</b>	<b>80</b>	60.1
<b>Distillation</b>			
Initial Boiling Point (IBP), (°C)		<b>Report</b>	240.3
10% (T10), (°C)	<b>191</b>	<b>290</b>	243.9
50% (T50), (°C)		<b>Report</b>	244.4
90% (T90), (°C)	<b>230</b>	<b>357</b>	245.1
Final Boiling Point (FBP), (°C)	<b>235</b>	<b>385</b>	258.4
Residue + Loss, (vol %)		<b>3.0</b>	1.7
T50-T10, (°C)		<b>Report</b>	0.5
T90-T10, (°C)		<b>Report</b>	1.2
<b>Heating Value:</b> (MJ/kg)	<b>43.0</b>		43.786
<b>MSEP, Diesel:</b>	<b>85</b>		85
<b>Acid Number:</b> (mg KOH/g)		<b>0.08</b>	0.08
<b>Hydrocarbon Composition:</b>			
Paraffins (normal and iso), (mass %)	<b>84.5</b>		84.5
Cyclo Paraffins, (mass %)		<b>15.0</b>	15
Total Aromatics, (mass %)		<b>0.5</b>	0.5
<b>Sulfur Content:</b> (ppm)		<b>15</b>	0.15
<b>Nitrogen Content:</b> (ppm)		<b>10</b>	0.10
<b>Metals:</b> (ppm)		<b>0.5 total</b>	0.10
<b>Alkali Metals and Metalloids:</b> (ppm)		<b>1 total</b>	0.99

Table 3-12: Direct Sugar to Hydrocarbon Conversion (DSH76), 2013 Test Results

**Note:** Values obtained for sulfur content and nitrogen content are below the test method detection limits.

### 3. Product Data

#### HDCD76—2013 Data Summary

Table 3-13 displays Hydroprocessed Depolymerized Cellulosic Diesel (HDCD76) Blend Stock results for the 2013 reporting period. One analysis was queried from the PQIS, but the volume was not recorded. All batches met specification requirements for all fuel properties measured in 2013. A waiver was in place for the nitrogen content value, which exceeded the maximum specification limit. The nitrogen content value met the limit established by the waiver.

Hydroprocessed Depolymerized Cellulosic Diesel (HDCD-76) Blend Stock			
Property	Specification Limits		2013 Test Results
	Min	Max	
Flash Point: (°C)	60		60.0
Density: (kg/L @ 15 °C)	0.772	0.910	0.910
Total Water: (ppm)		200	23.8
Particulate: (mg/L)		1.0	0.20
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	1.7	4.3	2.900
Cetane Number	22		25.7
Distillation			
Initial Boiling Point, (°C)	Report		168.7
10% (T10), (°C)	191	290	204.3
50% (T50), (°C)	Report		257.4
90% (T90), (°C)	295	357	326.3
Final Boiling Point, (°C)	310	385	347.4
Residue + Loss, (vol %)		3.0	2.2
T50-T10, (°C)	Report		53.1
T90-T10, (°C)	Report		122.0
Heating Value: (MJ/kg)	41.0		44.2
MSEP: (Diesel)	85		85
Acid Number: (mg KOH/g)		0.30	0.050
Hydrocarbon Composition:			
Paraffins (normal and iso), (mass %)	Report		0.4
Cyclo Paraffins, (mass %)	Report		65.2
Total Aromatics, (mass %)	Report		34.4
Sulfur Content: (ppm)		15	7.3
Nitrogen Content: (mg/kg)		10	25.0

Table 3-13: Hydroprocessed Depolymerized Cellulosic Diesel (HDCD-76) Blend Stock, 2013 Test Results

### 3. Product Data

#### LTL—2013 Data Summary

Table 3-14 displays LTL results for the 2013 reporting period. Ninety analyses were queried from the PQIS, representing 562.47 thousand U.S. gallons. All batches met specification requirements for all fuel properties measured in 2013. Five viscosity values (@ 40 °C) fell below the minimum specification limit of 77, but all were procured against the prior specification limits and met the minimum limit set by that specification.

For foaming sequences, individual batch results can be viewed in the database on the CD.

MIL-PRF-17331, Lubricating Oil, Steam Turbine and Gear, Moderate Service (LTL)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
Sulfur: (%)	Report		0.000	0.080	0.003	0.003
Acid Number: (mg KOH/g oil)		0.3	0.060	0.300	0.274	0.278
Corrosion (in presence of salt water)	None		None	None	None	None
Corrosion Test @ 100 °C, (Copper strip): (appearance)		1	1	1	1	1
Water: (%)	0.01		0.0000	0.0000	0.0000	0.0000
Gravity: (API)	Report		30.30	32.60	31.02	30.97
Flash Point: (°C)	204		205.0	267.0	248.7	249.4
Pour Point: (°C)		-6	-42.0	-18.0	-25.9	-25.6
Viscosity:						
mm <sup>2</sup> /s @ 4.4 °C		870	739.84	857.20	817.67	820.62
mm <sup>2</sup> /s @ 40 °C	77	97	75.03	80.23	78.75	78.77
mm <sup>2</sup> /s @ 100 °C		8.0	9.547	10.270	9.808	9.795
Oxidation by rotating pressure vessel: (minutes to failure)	Report		200.0	305.0	248.3	247.0
Cleanliness: (mg/100 mL)		2.5	0.00	2.00	0.17	0.15

Table 3-14: MIL-PRF-17331, Lubricating Oil, Steam Turbine and Gear, Moderate Service (LTL), 2013 Test Results

### 3. Product Data

#### LO6—2013 Data Summary

Table 3-15 displays LO6 results for the 2013 reporting period. Twenty-five analyses were queried from the PQIS, representing 145.11 thousand U.S. gallons. All batches met specification requirements for all fuel properties measured in 2013.

For foaming sequences, individual batch results can be viewed in the database on the CD.

MIL-PRF-009000, Lubricating Oil, Shipboard Internal Combustion Engine, High-Output Diesel (LO6)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
Ash, sulfated: (%)	Report		0.000	1.840	1.299	1.284
Copper Strip Corrosion Test @ 100 °C: (appearance)	1b		NR	NR	NR	NR
Flash Point: (°C)	225		240.0	278.0	260.9	261.1
Gravity: (degree API)	Report		27.70	28.80	27.95	27.94
Pour Point: (°C)	-12		-36.0	-24.0	-33.4	-33.4
Sulfur:	Report		0.000	0.355	0.208	0.210
Total Base Number: (mg KOH/g)	12		12.10	13.30	12.59	12.60
Viscosity Index:	90		102.0	108.0	102.7	102.7
Viscosity: (cSt @ 100 °C)	12.5	16.3	14.07	14.36	14.24	14.24

Table 3-15: MIL-PRF-009000, Lubricating Oil, Shipboard Internal Combustion Engine, High-Output Diesel (LO6), 2013 Test Results

### 3. Product Data

#### LA6—2013 Data Summary

Table 3-16 displays LA6 results for the 2013 reporting period. Twenty-one analyses were queried from the PQIS, representing 93.44 thousand U.S. gallons. All batches met specification requirements for all fuel properties measured in 2013.

MIL-PRF-6081, Lubricating Oil, Jet Engine, Grade 1010 (LA6)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
Acid Number (T.A.N): (mg KOH/g)		0.10	0.016	0.092	0.054	0.050
Viscosity:						
cs @ 37.8 °C	10.0		10.350	11.750	11.119	11.172
cs @ -40 °C		3,000	2,001.0	2,294.0	2,154.7	2,166.3
Viscosity Stability cs: (% Change @ 3 hours)						
-40 °C		2	0.00	0.74	0.30	0.34
Flash Point: (°C)	132		135.0	140.0	136.9	136.9
Pour Point: (°C)		-57	-69.0	-63.0	-66.4	-66.7
ASTM Color:		No. 5.5	1.0	2.0	1.4	1.4
Copper Strip Corrosion: (@ 100 ± °C)		1	1	1	1	1
Trace Sediment: (mL/200 mL of oil)		0.005	0.000	0.005	0.001	0.001

Table 3-16: MIL-PRF-6081, Lubricating Oil, Jet Engine, Grade 1010 (LA6), 2013 Test Results

### 3. Product Data

#### FSII—2013 Data Summary

Table 3-17 displays FSII results for the 2013 reporting period. Two hundred thirty-one analyses were queried from the PQIS, representing 1.11 million U.S. gallons. All batches met specification requirements for all fuel properties measured in 2013.

MIL-DTL-85470, Inhibitor, Icing, Fuel System, High Flash NATO Code S-1745 (FSII)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Acid Number:</b> (mg KOH/g)		<b>0.09</b>	0.0004	0.0840	0.0273	0.0268
<b>Color:</b> (platinum cobalt)		<b>10</b>	1.00	6.00	3.03	3.05
<b>Distillation:</b>						
Initial Point (°C)	<b>191.0</b>		192.0	194.9	193.2	193.2
Dry Point (°C)		<b>198.0</b>	194.6	196.0	195.4	195.4
<b>Ethylene Glycol:</b> (% by weight)		<b>0.5</b>	0.000	0.100	0.009	0.010
<b>pH of 25% solution in water:</b> (25+/- 2 °C)	<b>5.5</b>	<b>7.5</b>	6.10	7.50	6.84	6.84
<b>Relative Density:</b> (20/20 °C)	<b>1.021</b>	<b>1.025</b>	1.0210	1.0238	1.0216	1.0216
<b>Water:</b> (mass %)		<b>0.1</b>	0.0005	0.0300	0.0152	0.0148
<b>Flash Point:</b> (°C)	<b>85</b>		85.0	104.0	95.7	95.8

Table 3-17: MIL-DTL-85470, Inhibitor, Icing, Fuel System, High Flash NATO Code S-1745 (FSII), 2013 Test Results

## 2013 Product Detailed Assessment Reporting

Product detailed assessments provide minimum, maximum, mean, and volumetrically weighted mean values for each fuel property of the specified grade. These values are presented in table form, providing volumes processed through the PQIS database and regional sources. Also provided are histograms. When significant trending is observed, trend charts based on weighted mean values are presented.

The conformance tables in this report are illustrative in nature and may not represent 100 percent of the particular fuel characteristic, but they delineate sufficient data points to provide an accurate representation. The arithmetic means are based on “occurrence averages”—for example, averaging on submitted data for the characteristic. The tables reflect the number of reports constituting the data set and the corresponding volume in millions of gallons.

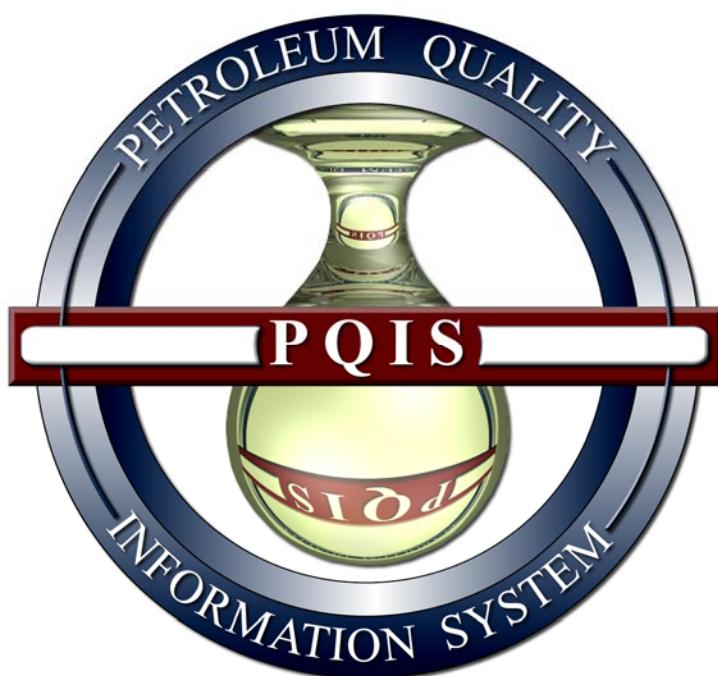
Comments noting observed trends are included in the assessment summary for each product where appropriate. These data reflect “Level A procurement quality test data” and do not include values throughout the distribution cycle.

The Level A data reflecting the spectender terminal source or refinery testing set the baseline in fuel quality considerations downstream. Various transport mediums (pipelines, tankers, and tank trucks) and storage conditions can affect product quality.

Batch integrity also may be compromised during the process. DLA Energy–FEQB can provide transportation data for first-, second-, and third-tier bulk deliveries, but not information on distribution or what constitutes an individual allotment.

Test properties reported in the following sections are specific to JP8, JP5, JA1, F76, MGO, and TS1. Trends noted in these sections are general in nature. Tables showing regional statistics also are provided. Most fuels met all specification requirements. In the few batches where test results were off specification, they were waived, reported incorrectly by the refiner, or transcribed incorrectly into the database.

### 3. Product Data





## 4. JP8–2013 Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)			
Property	2013 Source Inputs		
	Region	Volume	Analysis
<b>Total Acid Number:</b> (mg KOH/g)	All	1,023.83	1,052
<b>Aromatics:</b> (vol %)	All	1,021.80	1,047
<b>Sulfur Mercaptan:</b> (mass %)	All	837.39	931
<b>Sulfur, Total:</b> (mass %)	All	999.91	1,036
<b>Distillation:</b>			
Initial Boiling Point (IBP), (°C)	All	1,061.51	1,145
10% Recovered, (°C)	All	1,064.83	1,160
20% Recovered, (°C)	All	1,058.36	1,144
50% Recovered, (°C)	All	1,064.83	1,160
90% Recovered, (°C)	All	1,064.83	1,160
Final Boiling Point (FBP), (°C)	All	1,064.45	1,159
Residue, (vol %)	All	914.40	937
Loss, (vol %)	All	913.98	935
<b>Flash Point:</b> (°C)	All	1,063.18	1,175
<b>Density:</b> (kg/L @ 15 °C)	All	886.98	825
<b>Gravity:</b> (API @ 60 °F)	All	947.29	1,025
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)	All	1,017.96	1,043
<b>Freezing Point:</b> (°C)	All	1,064.83	1,161
<b>Net Heat of Combustion:</b> (MJ/kg)	All	1,022.90	1,048
<b>Cetane Index:</b> (calculated)	All	990.89	1,107
<b>Hydrogen Content:</b> (mass %)	All	1,017.03	1,032
<b>Smoke Point:</b> (mm)	All	1,023.83	1,051
<b>Naphthalenes:</b> (vol %)	All	758.42	662
<b>Thermal Stability:</b>			
Change in pressure drop, mm Hg @ 275°C	All	966.48	1,018
Change in pressure drop, mm Hg @ 260°C	All	12.59	21
<b>Existent Gum:</b> (mg/100 mL)	All	1,050.54	1,131
<b>Particulate Matter:</b> (mg/L)	All	1,059.09	1,151
<b>Filtration Time:</b> (minutes)	All	1,033.68	1,145
<b>Microseparometer (MSEP):</b> (rating)	All	1,031.28	1,049
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	All	285.14	417

Table 4-1: Data Summary, MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8), 2013 Source Inputs

## 4. JP8–2013 Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0002	0.0200	0.0061	0.0056
<b>Aromatics:</b> (vol %)		<b>25.0</b>	8.2	24.3	16.25	16.94
<b>Sulfur Mercaptan:</b> <sup>1</sup> (mass %)		<b>0.002</b>	0.0000	0.0020	0.0009	0.0008
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.000	0.300	0.060	0.076
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	<b>Report</b>		76.1	184.0	144.2	150.1
10% Recovered, (°C)	<b>205</b>		144.6	200.9	170.2	172.5
20% Recovered, (°C)	<b>Report</b>		163.4	211.0	178.4	180.1
50% Recovered, (°C)	<b>Report</b>		169.9	254.0	200.2	200.9
90% Recovered, (°C)	<b>Report</b>		206.5	285.0	243.2	242.5
Final Boiling Point (FBP), (°C)	<b>300</b>		229.3	318.9	270.4	268.1
Residue, (vol %)	<b>1.5</b>		0.00	1.50	1.08	1.03
Loss, (vol %)	<b>1.5</b>		0.00	1.50	0.77	0.73
<b>Flash Point:</b> (°C)	<b>38</b>		38.0	67.0	47.2	47.1
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7834	0.8336	0.8020	0.7999
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	38.20	50.60	44.28	44.70
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	2.800	7.728	4.279	4.347
<b>Freezing Point:</b> (°C)		<b>-47</b>	-80.0	-47.0	-52.2	-50.8
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		42.800	45.090	43.268	43.281
<b>Cetane Index:</b> (calculated)	<b>Report</b>		32.4	52.2	43.2	44.2
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.40	14.66	13.88	13.90
<b>Smoke Point:</b> <sup>2</sup> (mm)	<b>25.0</b>		19.00	30.00	23.35	23.39
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	0.00	2.79	1.31	1.16
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275°C	<b>25</b>		0.00	24.70	0.75	0.58
Change in pressure drop, mm Hg @ 260°C			0.00	15.80	1.40	1.97
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.00	7.00	0.89	1.05
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.00	1.00	0.35	0.37
<b>Filtration Time:</b> (minutes)		<b>15</b>	1	14	5.99	5.89
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		70	135	94.7	94.6
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	0.10	0.15	0.120	0.122

Table 4-2: Data Summary, MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8), 2013 Test Results

**Note 1:** Either the sulfur mercaptan limit or a negative doctor test result is acceptable to meet the specification requirement.

**Note 2:** When the smoke point result is below 25 mm, the product is acceptable so long as the naphthalene content is below 3.0 percent and the smoke point is greater than or equal to the minimum of 19 mm.

**Note 3:** See page 48 for an explanation of FSII specification limits for JP8.

**Note 4:** Some values obtained for sulfur, total are below the test method detection limits.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		12.42			
	Batch Analysis		7			
	Specification Limits		Region 1			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0010	0.0100	0.005	0.006
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.0	18.7	16.6	16.7
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.002</b>	0.0001	0.0016	0.0010	0.0011
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0710	0.1840	0.159	0.166
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	<b>Report</b>		149.0	154.2	151.9	151.5
10% Recovered, (°C)			<b>205</b>	167.9	173.1	170.1
20% Recovered, (°C)	<b>Report</b>		172.5	179.4	175.5	176.3
50% Recovered, (°C)	<b>Report</b>		188.8	195.2	191.1	192.0
90% Recovered, (°C)	<b>Report</b>		220.7	230.9	227.6	228.6
Final Boiling Point (FBP), (°C)	<b>300</b>		241.6	258.0	253.4	254.9
Residue, (vol %)	<b>1.5</b>		0.20	1.20	0.96	0.92
Loss, (vol %)	<b>1.5</b>		0.10	1.50	0.64	0.72
<b>Flash Point:</b> (°C)	<b>38</b>		40.0	43.0	41.9	42.2
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7910	0.7960	0.7928	0.7927
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	46.20	47.20	46.84	46.86
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	3.318	3.756	3.570	3.608
<b>Freezing Point:</b> (°C)		<b>-47</b>	-64.0	-47.0	-55.0	-52.8
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.268	43.400	43.315	43.314
<b>Cetane Index:</b> (calculated)	<b>Report</b>		42.0	45.1	43.5	43.9
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.88	14.00	13.94	13.94
<b>Smoke Point:</b> (mm)	<b>25.0</b>		21.0	23.0	22.3	22.0
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	0.88	1.17	1.03	1.02
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	<b>25</b>		0.00	1.00	0.57	0.41
Change in pressure drop, mm Hg @ 260 °C			NR	NR	NR	NR
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.00	2.40	1.63	1.61
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.15	0.33	0.24	0.22
<b>Filtration Time:</b> (minutes)		<b>15</b>	4	12	8.29	9.26
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		97	97	97.0	97.0
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	0.12	0.14	0.129	0.130

Table 4-3: Region 1 Summary

**Note:** See page 48 for an explanation of FSII specification limits for JP8.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		185.84			
	Batch Analysis		361			
	Specification Limits		Region 2			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0003	0.0112	0.003	0.003
<b>Aromatics:</b> (vol %)		<b>25.0</b>	8.2	23.0	15.2	15.2
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.002</b>	0.0000	0.0019	0.0008	0.0007
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0000	0.3000	0.035	0.035
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	<b>Report</b>		76.10	184.0	126.2	136.6
10% Recovered, (°C)	<b>205</b>		152.0	200.9	170.0	174.0
20% Recovered, (°C)	<b>Report</b>		164.5	211.0	181.3	183.7
50% Recovered, (°C)	<b>Report</b>		169.9	254.0	205.9	205.2
90% Recovered, (°C)	<b>Report</b>		206.5	285.0	244.7	241.0
Final Boiling Point (FBP), (°C)	<b>300</b>		229.3	318.9	274.7	268.3
Residue, (vol %)	<b>1.5</b>		0.00	1.50	1.14	1.19
Loss, (vol %)	<b>1.5</b>		0.00	1.50	0.62	0.60
<b>Flash Point:</b> (°C)	<b>38</b>		38.0	66.0	49.9	49.4
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7888	0.8206	0.8029	0.8015
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	41.50	47.80	44.30	44.21
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	2.940	7.728	4.674	4.777
<b>Freezing Point:</b> (°C)		<b>-47</b>	-68.8	-47.0	-52.8	-53.4
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		42.800	43.900	43.275	43.276
<b>Cetane Index:</b> (calculated)	<b>Report</b>		38.2	46.6	44.3	44.0
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.52	14.53	13.86	13.86
<b>Smoke Point:</b> (mm)	<b>25.0</b>		21.0	30.0	23.9	24.1
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	0.11	2.08	1.27	1.06
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	<b>25</b>		0.00	24.70	0.36	0.26
Change in pressure drop, mm Hg @ 260 °C			0.00	0.50	0.11	0.25
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.00	5.00	0.73	0.77
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.02	1.00	0.33	0.33
<b>Filtration Time:</b> (minutes)		<b>15</b>	1	14	5.11	5.63
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		84	135	95.0	94.7
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	0.10	0.14	0.118	0.119

Table 4-4: Region 2 Summary

**Note 1:** See page 48 for an explanation of FSII specification limits for JP8.

**Note 2:** Some values obtained for sulfur, total are below the test method detection limits.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		467.90			
	Batch Analysis		320			
	Specification Limits		Region 3			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)	0.015	0.0008	0.0130	0.006	0.006	0.006
<b>Aromatics:</b> (vol %)	25.0	8.2	20.6	14.7	16.7	
<b>Sulfur Mercaptan:</b> (mass %)	0.002	0.0000	0.0020	0.0009	0.0008	
<b>Sulfur, Total:</b> (mass %)	0.30	0.0000	0.2004	0.065	0.072	
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	Report		107.0	184.0	155.9	155.1
10% Recovered, (°C)	205		147.0	193.0	175.3	176.4
20% Recovered, (°C)	Report		169.0	199.0	182.3	184.0
50% Recovered, (°C)	Report		186.0	216.0	200.4	204.1
90% Recovered, (°C)	Report		221.0	270.0	238.5	243.4
Final Boiling Point (FBP), (°C)	300		238.0	302.0	262.2	267.1
Residue, (vol %)	1.5		0.10	1.50	0.96	1.03
Loss, (vol %)	1.5		0.00	1.50	0.70	0.77
<b>Flash Point:</b> (°C)	38		40.0	67.0	49.3	49.1
<b>Density:</b> (kg/L @ 15 °C)	0.775	0.840	0.7834	0.8150	0.8009	0.8018
<b>Gravity:</b> (API @ 60 °F)	37.0	51.0	42.00	50.60	45.37	44.90
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)	8.0		2.800	7.100	4.372	4.665
<b>Freezing Point:</b> (°C)	-47		-60.0	-47.0	-52.0	-49.6
<b>Net Heat of Combustion:</b> (MJ/kg)	42.8		43.128	45.090	43.338	43.306
<b>Cetane Index:</b> (calculated)	Report		41.0	52.2	44.8	45.6
<b>Hydrogen Content:</b> (mass %)	13.4		13.60	14.66	14.02	13.98
<b>Smoke Point:</b> (mm)	25.0		19.0	30.0	24.3	23.4
<b>Naphthalenes:</b> (vol %)	3.0		0.00	2.79	1.26	1.28
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	25		0.00	14.00	0.86	0.63
Change in pressure drop, mm Hg @ 260 °C			NR	NR	NR	NR
<b>Existent Gum:</b> (mg/100 mL)	7.0		0.00	7.00	0.87	1.13
<b>Particulate Matter:</b> (mg/L)	1.0		0.00	1.00	0.30	0.31
<b>Filtration Time:</b> (minutes)	15		2	14	5.12	4.80
<b>Microseparometer (MSEP):</b> (rating)	70		73	100	93.5	95.3
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	0.07	0.10	0.10	0.14	0.119	0.119

Table 4-5: Region 3 Summary

**Note 1:** See page 48 for an explanation of FSII specification limits for JP8.

**Note 2:** Some values obtained for sulfur, total are below the test method detection limits.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		15.05			
	Batch Analysis		23			
	Specification Limits		Region 4			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0010	0.0120	0.004	0.004
<b>Aromatics:</b> (vol %)		<b>25.0</b>	13.2	23.7	17.2	16.4
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.002</b>	0.0000	0.0018	0.0009	0.0010
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0100	0.0954	0.052	0.058
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)		<b>Report</b>	144.0	179.0	158.7	155.9
10% Recovered, (°C)		<b>205</b>	170.0	192.0	178.0	176.8
20% Recovered, (°C)		<b>Report</b>	178.0	196.0	184.9	184.0
50% Recovered, (°C)		<b>Report</b>	201.0	210.0	204.3	204.4
90% Recovered, (°C)		<b>Report</b>	231.0	247.0	240.4	241.1
Final Boiling Point (FBP), (°C)		<b>300</b>	251.0	269.0	261.7	262.2
Residue, (vol %)		<b>1.5</b>	0.40	1.50	0.92	0.94
Loss, (vol %)		<b>1.5</b>	0.00	1.50	0.50	0.48
<b>Flash Point:</b> (°C)	<b>38</b>		42.0	57.0	48.5	47.6
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	NR	NR	NR	NR
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	42.00	44.90	43.76	43.94
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	4.200	5.070	4.476	4.487
<b>Freezing Point:</b> (°C)		<b>-47</b>	-60.0	-47.0	-50.9	-49.9
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.100	43.300	43.217	43.235
<b>Cetane Index:</b> (calculated)		<b>Report</b>	40.0	45.5	43.7	43.9
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.65	13.90	13.81	13.83
<b>Smoke Point:</b> (mm)	<b>25.0</b>		21.0	25.0	24.0	24.3
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	0.29	1.43	1.04	1.14
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C			0.00	3.00	0.76	1.00
Change in pressure drop, mm Hg @ 260 °C		<b>25</b>	0.00	0.00	0.00	0.00
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.20	5.00	1.16	1.23
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.00	0.80	0.21	0.19
<b>Filtration Time:</b> (minutes)		<b>15</b>	4	9	6.45	6.25
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		77	99	93.9	95.6
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	NR	NR	NR	NR

Table 4-6: Region 4 Summary

**Note:** See page 48 for an explanation of FSII specification limits for JP8.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		99.13			
	Batch Analysis		169			
	Specification Limits		Region 5			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0004	0.0110	0.005	0.005
<b>Aromatics:</b> (vol %)		<b>25.0</b>	8.3	24.3	16.8	18.1
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.002</b>	0.0000	0.0020	0.0013	0.0003
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0001	0.1600	0.073	0.030
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	<b>Report</b>		142.0	180.0	154.1	152.4
10% Recovered, (°C)	205		144.6	197.0	170.8	169.6
20% Recovered, (°C)	<b>Report</b>		163.4	206.0	177.8	176.8
50% Recovered, (°C)	<b>Report</b>		170.3	228.0	200.6	200.0
90% Recovered, (°C)	<b>Report</b>		211.4	274.4	247.5	245.5
Final Boiling Point (FBP), (°C)	300		257.0	284.5	273.6	272.5
Residue, (vol %)	1.5		0.40	1.50	1.18	1.08
Loss, (vol %)	1.5		0.00	1.50	0.89	0.69
<b>Flash Point:</b> (°C)	<b>38</b>		42.0	62.0	47.9	45.5
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.8000	0.8336	0.8191	0.8177
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	38.20	45.60	43.05	42.84
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	3.500	7.290	4.393	4.154
<b>Freezing Point:</b> (°C)		<b>-47</b>	-65.0	-47.5	-53.3	-52.0
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.000	43.372	43.191	43.146
<b>Cetane Index:</b> (calculated)	<b>Report</b>		32.4	44.5	40.3	39.0
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.40	14.10	13.71	13.66
<b>Smoke Point:</b> (mm)	<b>25.0</b>		19.0	25.0	20.6	20.8
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	0.09	2.27	1.24	0.87
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	25		0.00	3.00	0.34	0.10
Change in pressure drop, mm Hg @ 260 °C	NR		NR	NR	NR	NR
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.00	7.00	0.96	1.21
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.00	0.98	0.23	0.26
<b>Filtration Time:</b> (minutes)		<b>15</b>	3	13	4.27	6.62
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		79	100	96.7	94.9
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	0.10	0.15	0.122	0.146

Table 4-7: Region 5 Summary

**Note:** See page 48 for an explanation of FSII specification limits for JP8.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		85.15			
	Batch Analysis		141			
	Specification Limits		Region 6			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0090	0.0110	0.010	0.010
<b>Aromatics:</b> (vol %)		<b>25.0</b>	16.5	21.4	19.1	19.0
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.002</b>	0.0005	0.0018	0.0010	0.0009
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0270	0.0930	0.037	0.038
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)		<b>Report</b>	145.0	150.0	147.2	147.0
10% Recovered, (°C)		<b>205</b>	158.0	167.0	161.2	161.2
20% Recovered, (°C)		<b>Report</b>	164.0	175.0	167.1	167.1
50% Recovered, (°C)		<b>Report</b>	171.0	193.0	187.4	187.4
90% Recovered, (°C)		<b>Report</b>	235.0	250.0	244.2	243.9
Final Boiling Point (FBP), (°C)		<b>300</b>	260.0	285.0	279.1	278.6
Residue, (vol %)		<b>1.5</b>	1.20	1.30	1.21	1.21
Loss, (vol %)		<b>1.5</b>	1.00	1.00	1.00	1.00
<b>Flash Point:</b> (°C)	<b>38</b>		38.0	40.0	38.4	38.5
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7882	0.7920	0.7899	0.7898
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	NR	NR	NR	NR
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	3.100	3.900	3.359	3.361
<b>Freezing Point:</b> (°C)		<b>-47</b>	-51.5	-49.0	-50.7	-50.7
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		42.850	43.363	43.321	43.328
<b>Cetane Index:</b> (calculated)		<b>Report</b>	41.2	45.3	43.0	43.0
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.82	13.99	13.91	13.92
<b>Smoke Point:</b> (mm)	<b>25.0</b>		25.0	25.0	25.0	25.0
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	NR	NR	NR	NR
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C			2.00	2.00	2.00	2.00
Change in pressure drop, mm Hg @ 260 °C		<b>25</b>	NR	NR	NR	NR
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	1.00	1.00	1.00	1.00
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.60	0.85	0.71	0.76
<b>Filtration Time:</b> (minutes)		<b>15</b>	11	12	11.99	12.00
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		90	98	94.9	94.8
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	0.12	0.12	0.120	0.120

Table 4-8: Region 6 Summary

**Note:** See page 48 for an explanation of FSII specification limits for JP8.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		32.33			
	Batch Analysis		8			
	Specification Limits		Region 7			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0030	0.0090	0.008	0.008
<b>Aromatics:</b> (vol %)		<b>25.0</b>	14.7	20.5	16.1	16.0
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.002</b>	0.0004	0.0020	0.0017	0.0017
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0210	0.3000	0.234	0.248
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	<b>Report</b>		148.0	167.9	152.7	152.1
10% Recovered, (°C)			<b>205</b>	165.0	182.2	168.7
20% Recovered, (°C)	<b>Report</b>		171.0	186.5	175.9	175.9
50% Recovered, (°C)	<b>Report</b>		192.0	203.0	197.5	197.9
90% Recovered, (°C)	<b>Report</b>		233.0	248.0	239.3	240.2
Final Boiling Point (FBP), (°C)	<b>300</b>		254.0	262.0	258.3	258.3
Residue, (vol %)	<b>1.5</b>		1.00	1.30	1.15	1.12
Loss, (vol %)	<b>1.5</b>		0.70	1.00	0.83	0.83
<b>Flash Point:</b> (°C)	<b>38</b>		42.0	60.0	45.6	45.3
<b>Density:</b> (kg/L @ 15 °C)	<b>0.775</b>	<b>0.840</b>	0.7918	0.8114	0.7962	0.7955
<b>Gravity:</b> (API @ 60 °F)	<b>37.0</b>	<b>51.0</b>	NR	NR	NR	NR
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.0</b>	3.470	4.349	3.752	3.706
<b>Freezing Point:</b> (°C)		<b>-47</b>	-80.0	-48.0	-54.0	-53.5
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.8</b>		43.130	43.350	43.274	43.281
<b>Cetane Index:</b> (calculated)	<b>Report</b>		40.8	45.6	43.7	43.7
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.57	14.08	13.95	13.96
<b>Smoke Point:</b> (mm)	<b>25.0</b>		21.0	25.0	24.3	24.4
<b>Naphthalenes:</b> (vol %)		<b>3.0</b>	0.34	1.50	0.92	0.77
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	<b>25</b>		0.00	1.00	0.75	0.81
Change in pressure drop, mm Hg @ 260 °C			NR	NR	NR	NR
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	1.00	2.00	1.75	1.80
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.39	0.78	0.62	0.58
<b>Filtration Time:</b> (minutes)		<b>15</b>	4	13	7.00	6.56
<b>Microseparometer (MSEP):</b> (rating)	<b>70</b>		94	98	96.4	96.4
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.07</b>	<b>0.10</b>	NR	NR	NR	NR

Table 4-9: Region 7 Summary

**Note:** See page 48 for an explanation of FSII specification limits for JP8.

## 4. JP8–2013 Regional Data Summary

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F34 (JP8)						
Property	Total Volume		167.02			
	Batch Analysis		106			
	Specification Limits		Region 8			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		0.015	0.0002	0.0200	0.012	0.005
<b>Aromatics:</b> (vol %)		25.0	14.6	22.7	18.9	18.1
<b>Sulfur Mercaptan:</b> (mass %)		0.002	0.0002	0.0015	0.0009	0.0009
<b>Sulfur, Total:</b> (mass %)		0.30	0.0250	0.2300	0.112	0.132
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)	Report		135.6	156.0	145.7	150.3
10% Recovered, (°C)	205		158.5	173.1	165.0	167.9
20% Recovered, (°C)	Report		167.6	180.7	172.6	174.6
50% Recovered, (°C)	Report		188.1	202.2	196.7	195.3
90% Recovered, (°C)	Report		225.1	257.4	244.6	240.7
Final Boiling Point (FBP), (°C)	300		249.0	288.3	265.8	266.0
Residue, (vol %)	1.5		0.20	1.40	1.03	0.79
Loss, (vol %)	1.5		0.00	1.50	0.80	0.63
<b>Flash Point:</b> (°C)	38		38.0	48.0	42.6	44.5
<b>Density:</b> (kg/L @ 15 °C)	0.775	0.840	0.7877	0.8151	0.8051	0.7976
<b>Gravity:</b> (API @ 60 °F)	37.0	51.0	42.00	48.10	44.21	45.73
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		8.0	3.239	4.604	4.034	3.750
<b>Freezing Point:</b> (°C)		-47	-57.0	-47.0	-49.6	-50.1
<b>Net Heat of Combustion:</b> (MJ/kg)	42.8		43.000	43.400	43.141	43.272
<b>Cetane Index:</b> (calculated)	Report		37.5	46.2	40.7	43.3
<b>Hydrogen Content:</b> (mass %)	13.4		13.49	14.10	13.83	13.85
<b>Smoke Point:</b> (mm)	25.0		20.0	24.0	21.8	23.2
<b>Naphthalenes:</b> (vol %)		3.0	0.50	2.62	1.83	1.12
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	25		0.00	3.00	0.40	0.17
Change in pressure drop, mm Hg @ 260 °C			0.00	15.80	2.85	3.22
<b>Existent Gum:</b> (mg/100 mL)		7.0	0.00	2.40	0.99	0.84
<b>Particulate Matter:</b> (mg/L)		1.0	0.00	0.90	0.30	0.46
<b>Filtration Time:</b> (minutes)		15	3	7	5.10	5.39
<b>Microseparometer (MSEP):</b> (rating)	70		76	100	94.4	91.6
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	0.07	0.10	0.10	0.13	0.122	0.122

Table 4-10: Region 8 Summary

**Note:** See page 48 for an explanation of FSII specification limits for JP8.

## 4. JP8—Assessment Summary

### **Overview:**

In 2013, 1,180 reported analyses, representing 1,064.83 million U.S. gallons of JP8, were processed in the PQIS by Regions 1–8. This represents a decrease from the 1,373 reported analyses and 1,723.48 million U.S. gallons queried from the PQIS in 2012.

### **Significant Trending:**

**Sulfur Mercaptan.** The weighted mean decreased 0.0002 mass % from 2010 to 2013.

**Sulfur, Total.** The weighted mean increased 0.014 mass % from 2011 to 2013.

**Flash Point.** The weighted mean decreased 1.5 °C from 2009 to 2013.

**Density.** The weighted mean decreased 0.0044 kg/L @ 15 °C from 2011 to 2013 to a 13-year low of 0.7999 kg/L @ 15 °C.

**Freezing Point.** The weighted mean increased 1.6 °C from 2011 to 2013.

**Naphthalenes.** Aside from a slight increase from 2011 to 2012, the weighted mean decreased 0.22 vol % from 2009 to 2013.

### **JP8 Observations:**

All batches met specification requirements in 2013.

For **Total Acid Number**, a waiver was granted for a 0.020 mg KOH/g maximum limit for locations in Alaska. Fifty-two measurements from Alaska were greater than the maximum specification limit of 0.015 mg KOH/g, but all met the specification limit set by the waiver. These data are included in the data tables and figures.

For **Final Boiling Point**, a waiver was granted for seven values that exceeded the maximum limit of 300 °C.

In September 2012, **FSII** specification limits changed to 0.07-0.10 vol % because of the publication of MIL-DTL-83133H with amendment 1. Contracts in 2013 may fall under the MIL-DTL-83133H (without amendment 1) revision using specification limits 0.10-0.15 vol %.

For **MSEP**, all JP8 batches met specification requirements. The impact of additives provides for a wide variation (see Table 4-11). Batches were not separated by type of additives or group of additives for this reporting. The minimum MSEP ratings were as follows:

JP8 Additives	MSEP Rating, min
Antioxidant (AO), Metal Deactivator (MDA)	90
AO, MDA, and Fuel System Icing Inhibitor (FSII)	85
AO, MDA, and Corrosion Inhibitor/Lubricity Improver (CI/LI)	80
AO, MDA, FSII and CI/LI	70

Table 4-11: JP8 Additives and Associated MSEP Ratings

## Total Acid Number—2013

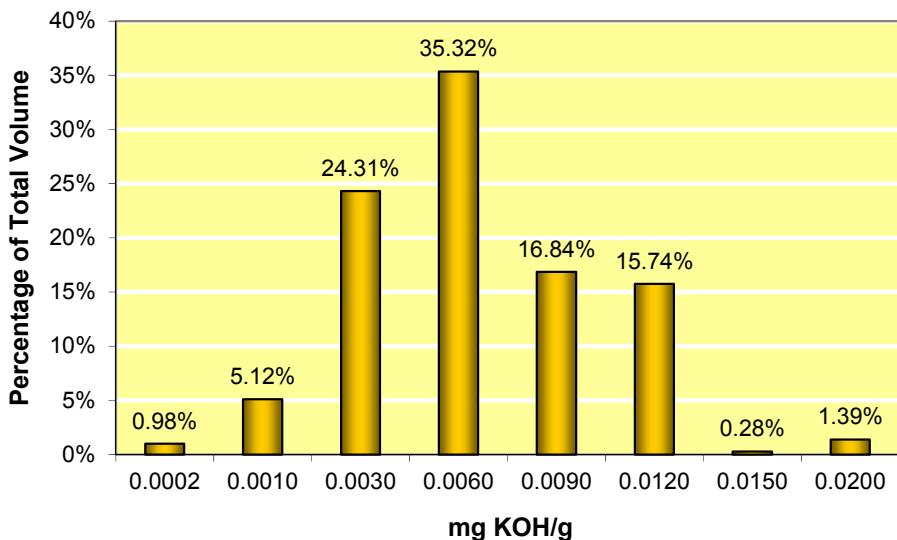


Figure 4-1: Total Acid Number (mg KOH/g), maximum 0.015

## Total Acid Number 13-Year Trend—Weighted Mean

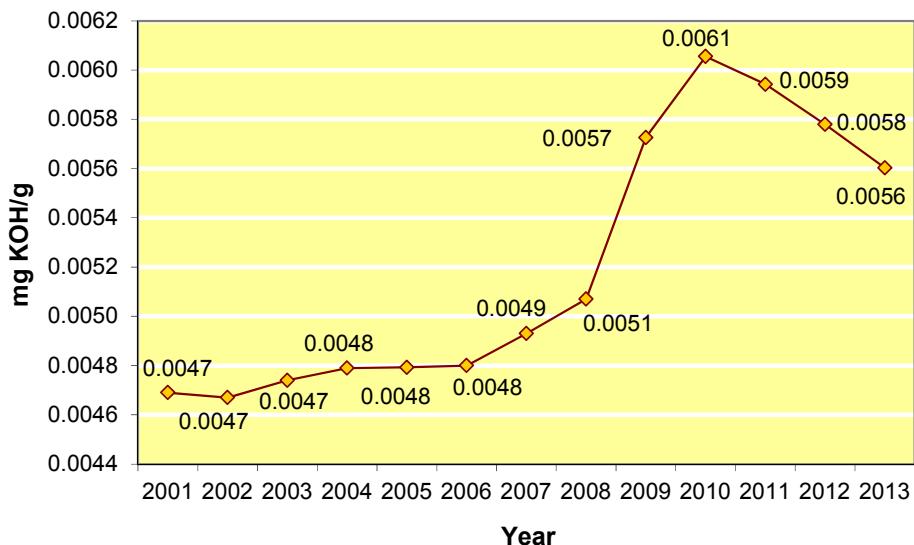


Figure 4-2: Total Acid Number (mg KOH/g), 13-Year Trend, maximum 0.015

## 4. JP8 Data

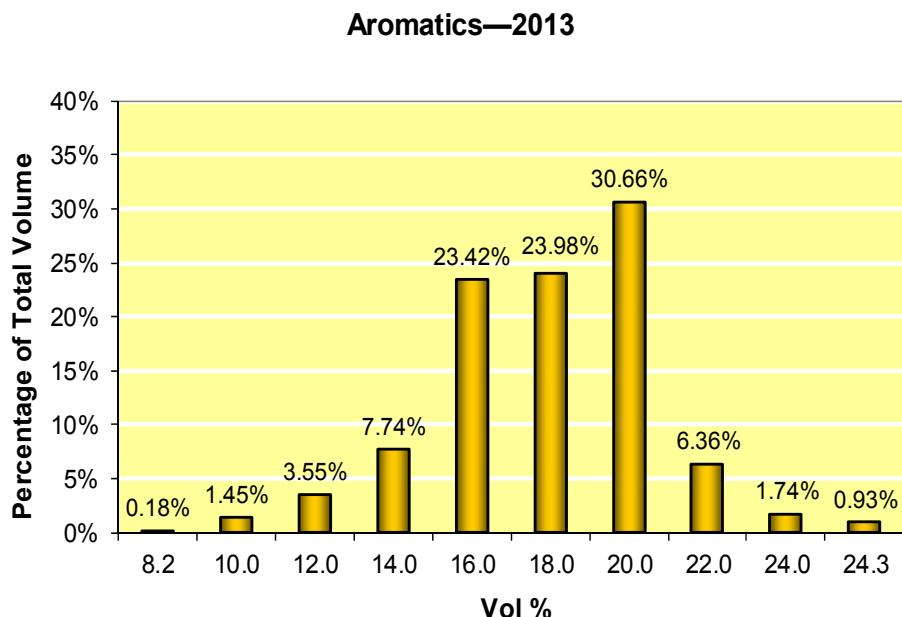


Figure 4-3: Aromatics (vol %), maximum 25.0

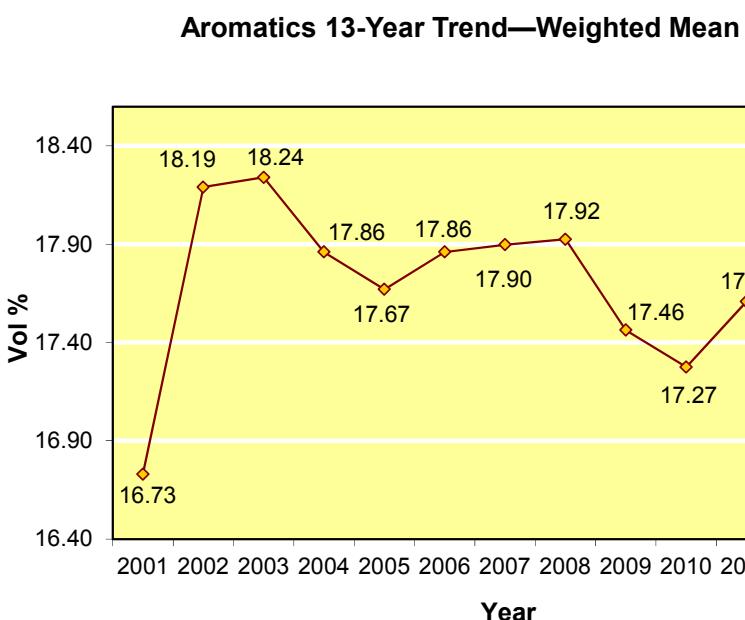


Figure 4-4: Aromatics (vol %), 13-Year Trend, maximum 25.0

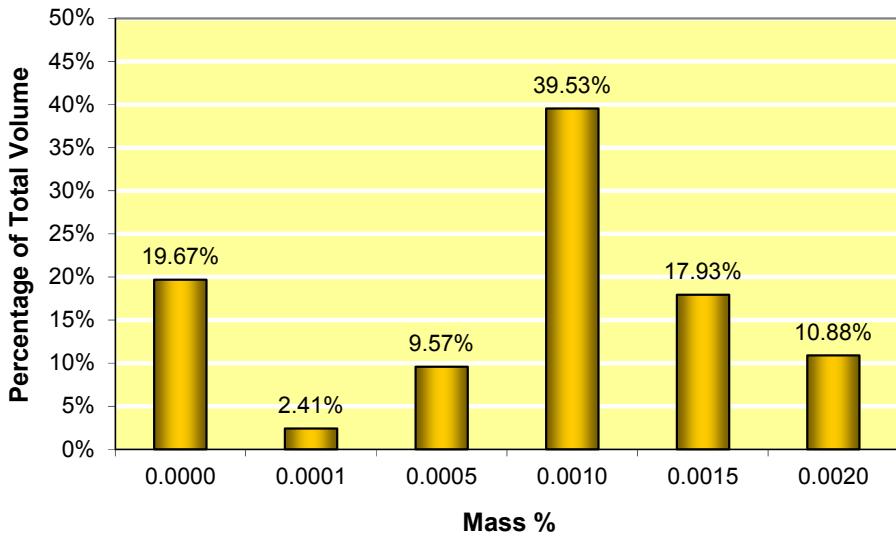
**Sulfur Mercaptan—2013**

Figure 4-5: Sulfur Mercaptan (mass %), maximum 0.002

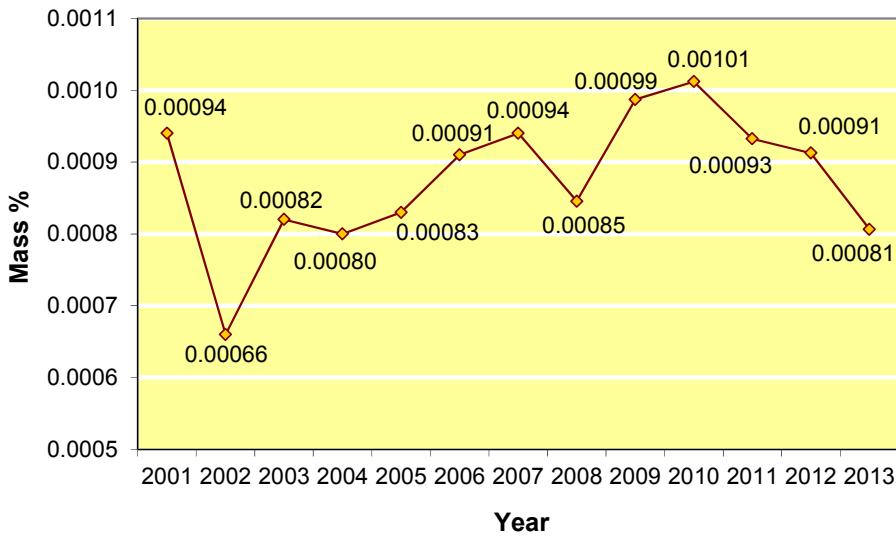
**Sulfur Mercaptan 13-Year Trend—Weighted Mean**

Figure 4-6: Sulfur Mercaptan (mass %), 13-Year Trend, maximum 0.002

## 4. JP8 Data

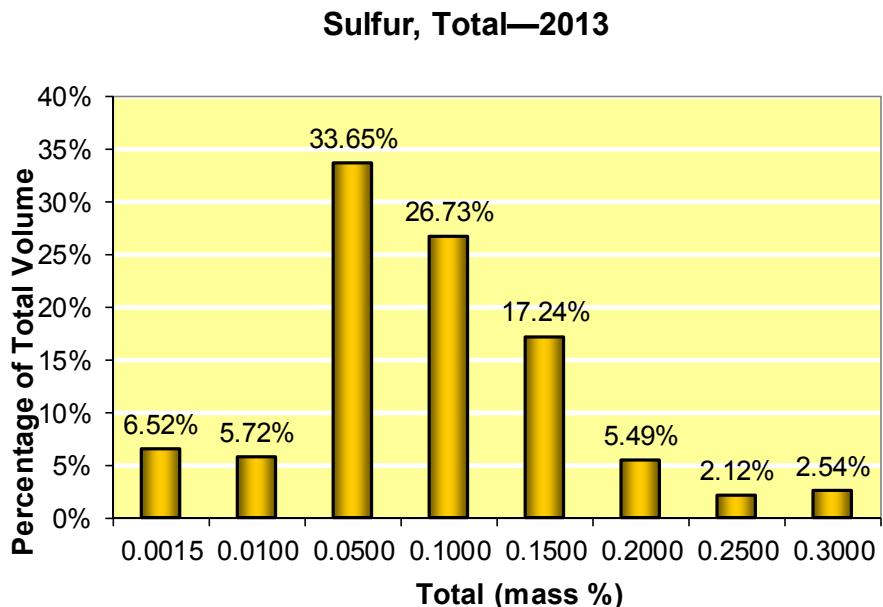


Figure 4-7: Sulfur, Total (mass %), maximum 0.30

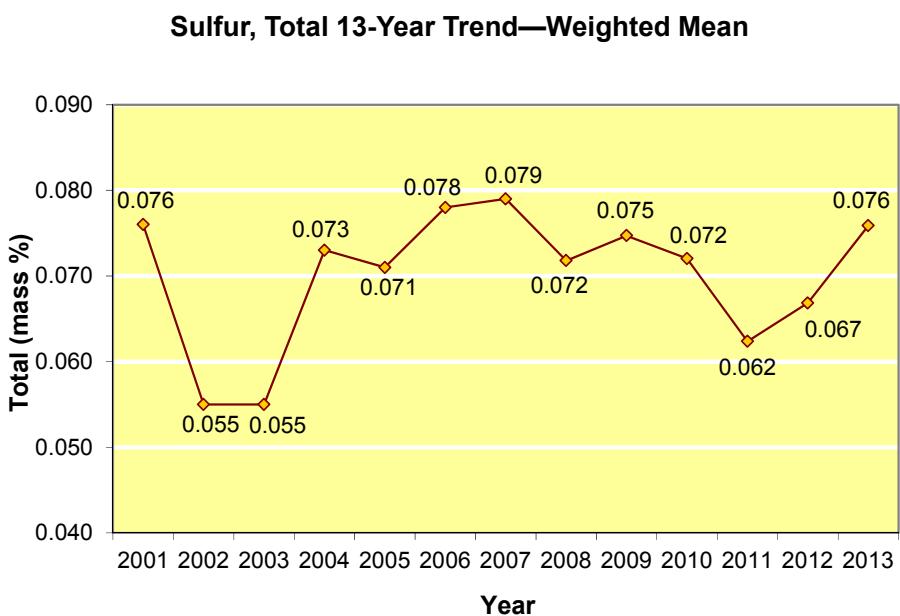


Figure 4-8: Sulfur, Total (mass %), 13-Year Trend, maximum 0.30

## Distillation Initial Boiling Point—2013

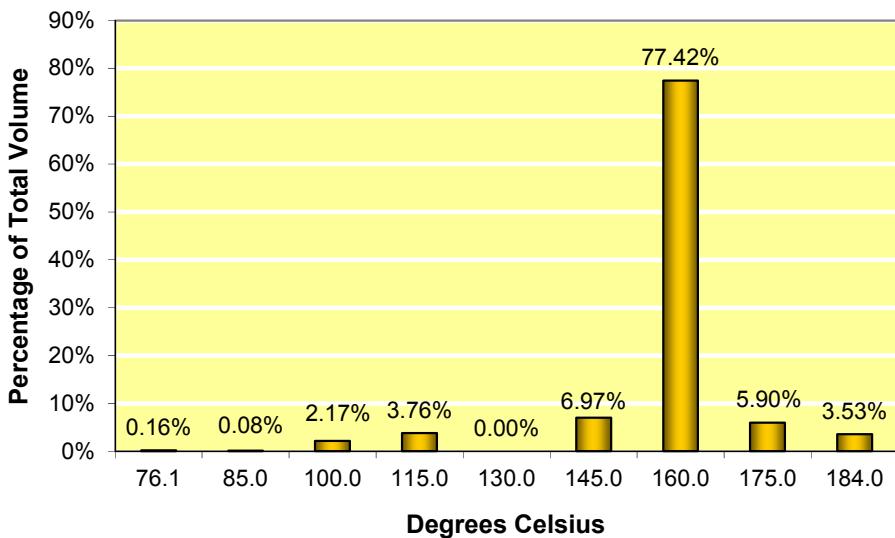


Figure 4-9: Distillation Initial Boiling Point (°C), Report

## Distillation 10% Recovered—2013

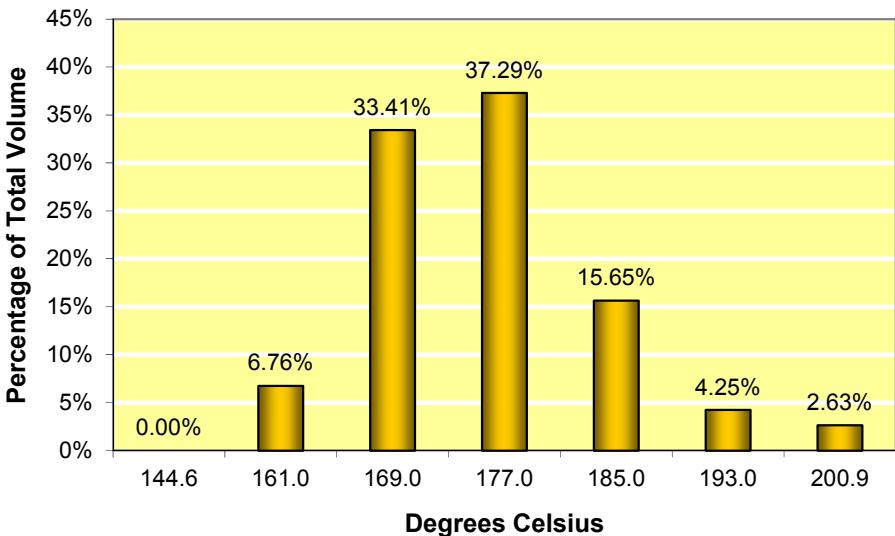


Figure 4-10: Distillation 10% Recovered (°C), maximum 205

## 4. JP8 Data

Distillation 20% Recovered—2013

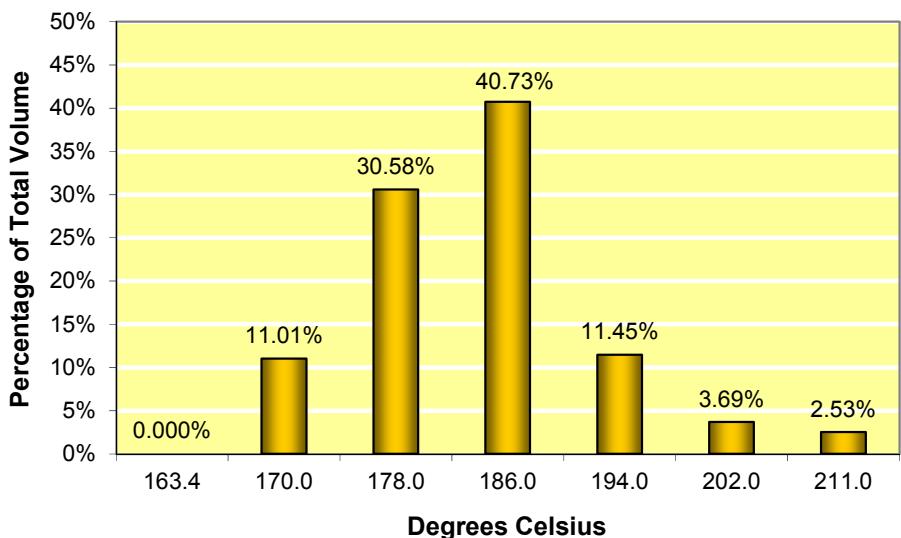


Figure 4-11: Distillation 20% Recovered (°C), Report

Distillation 50% Recovered—2013

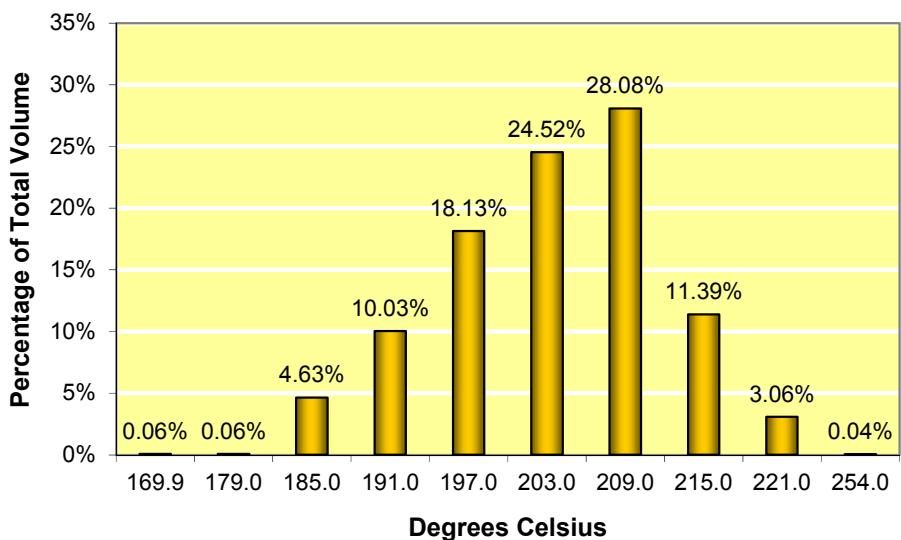


Figure 4-12: Distillation 50% Recovered (°C), Report

## Distillation 90% Recovered—2013

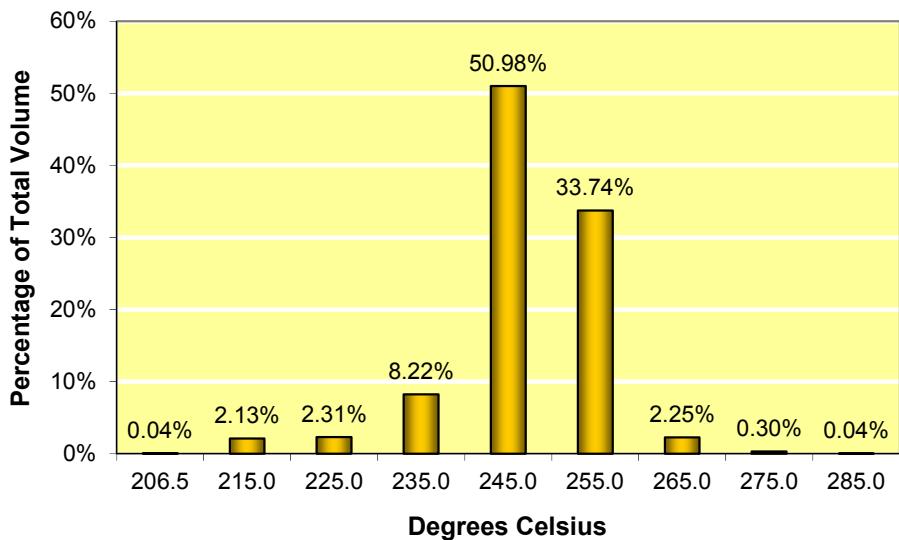


Figure 4-13: Distillation 90% Recovered (°C), Report

## Distillation Final Boiling Point—2013

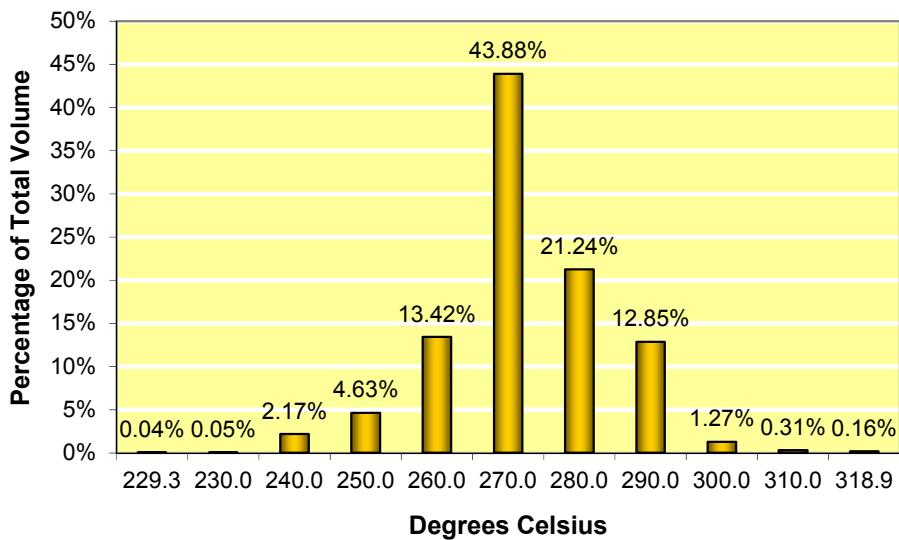


Figure 4-14: Distillation Final Boiling Point (°C), maximum 300

## 4. JP8 Data

Distillation Residue—2013

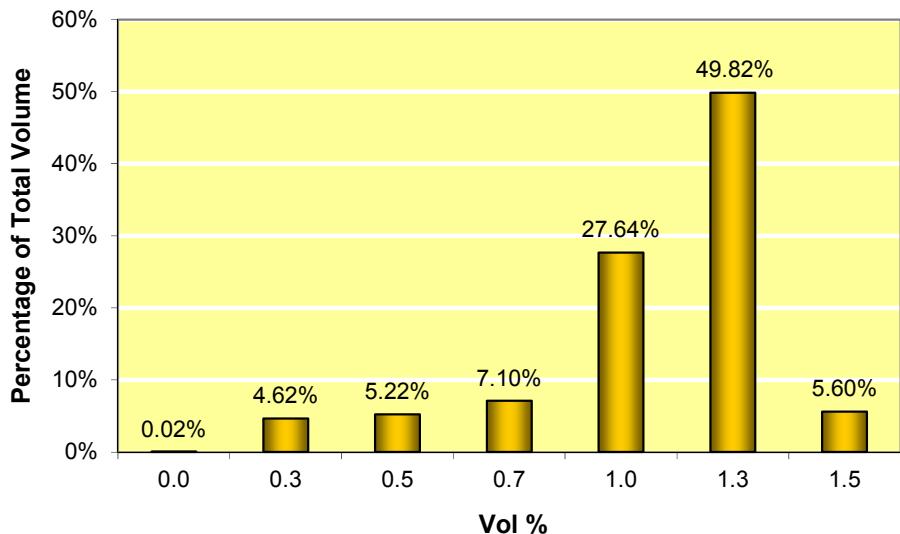


Figure 4-15: Distillation Residue (vol %), maximum 1.5

Distillation Loss—2013

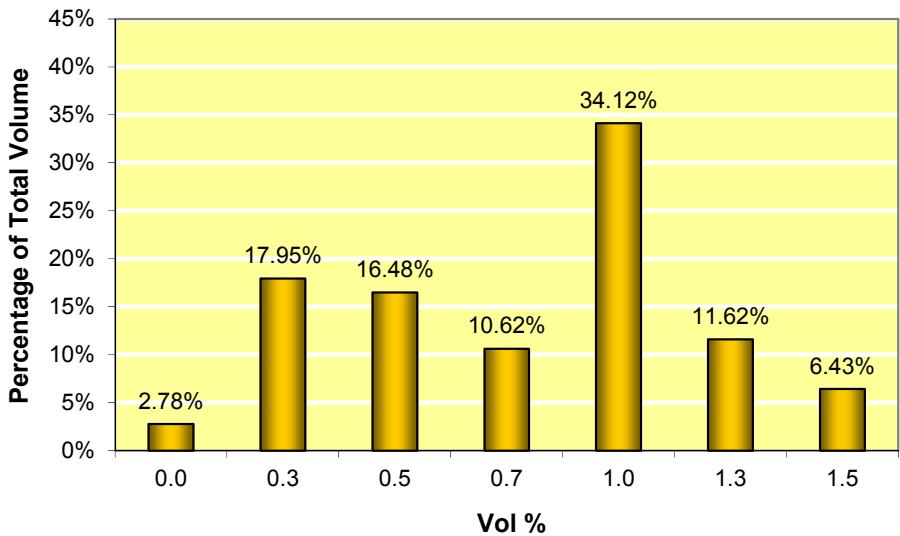


Figure 4-16: Distillation Loss (vol %), maximum 1.5

## Flash Point—2013

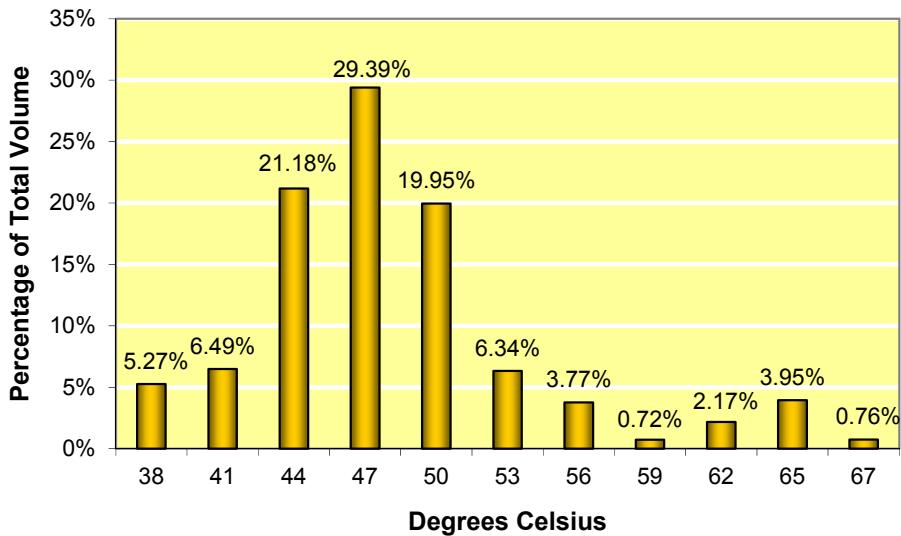


Figure 4-17: Flash Point (°C), minimum 38

## Flash Point 13-Year Trend—Weighted Mean

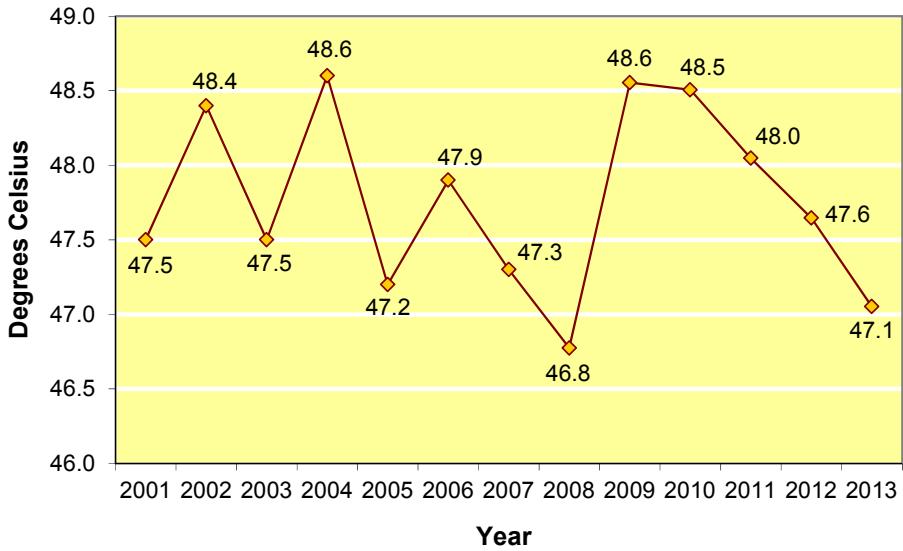


Figure 4-18: Flash Point (°C), 13-Year Trend, minimum 38

## 4. JP8 Data

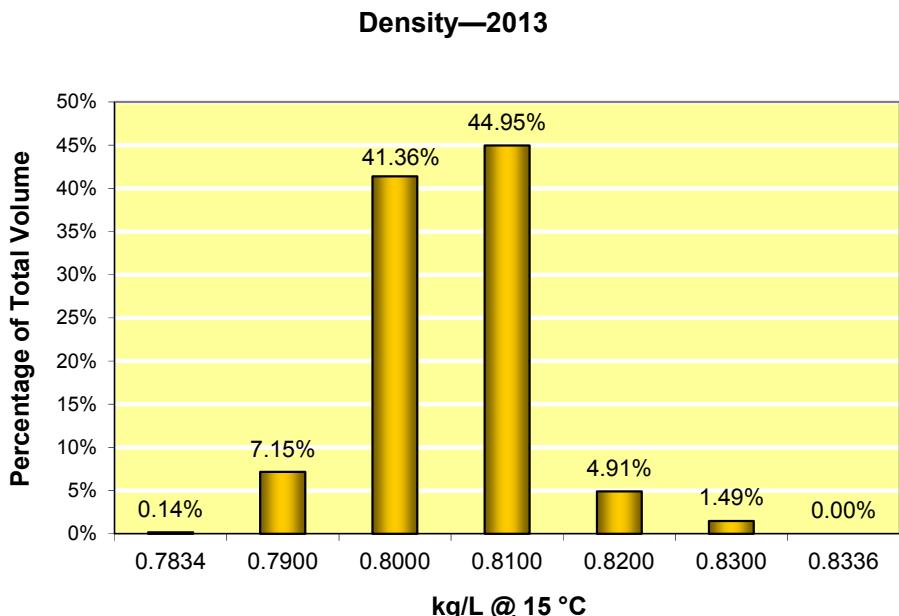


Figure 4-19: Density (kg/L @ 15 °C), minimum 0.775, maximum 0.840

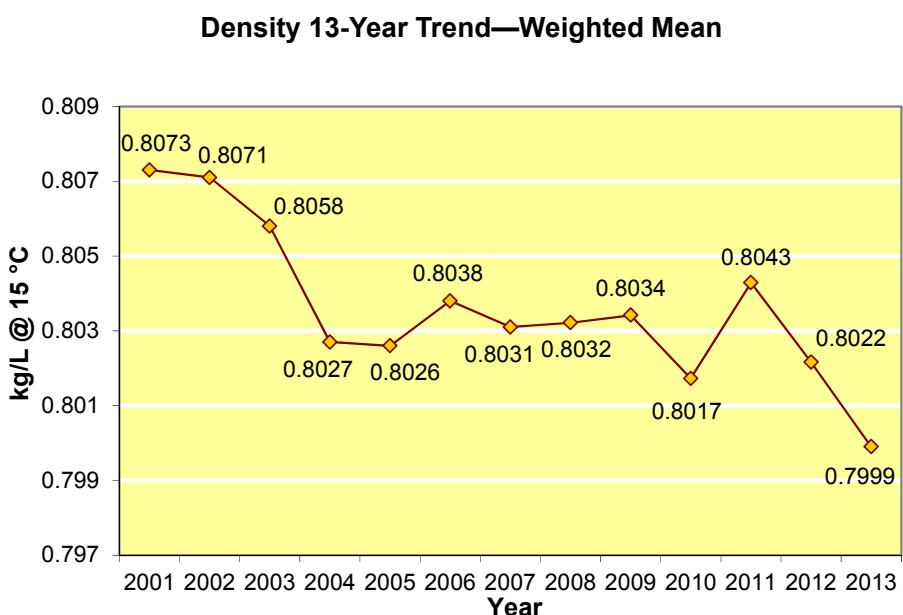


Figure 4-20: Density (kg/L @ 15 °C), 13-Year Trend, minimum 0.775, maximum 0.840

## Gravity—2013

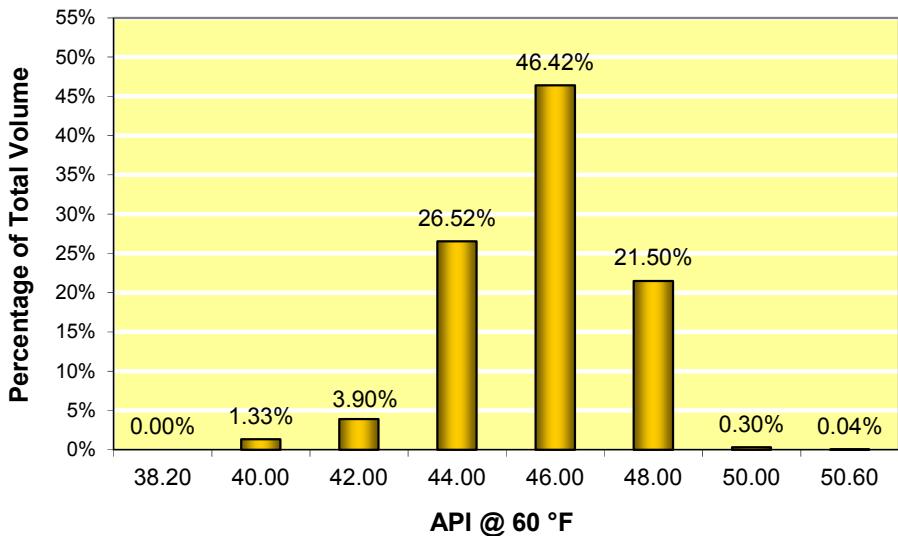


Figure 4-21: Gravity (API @ 60 °F), minimum 37.0, maximum 51.0

## Viscosity—2013

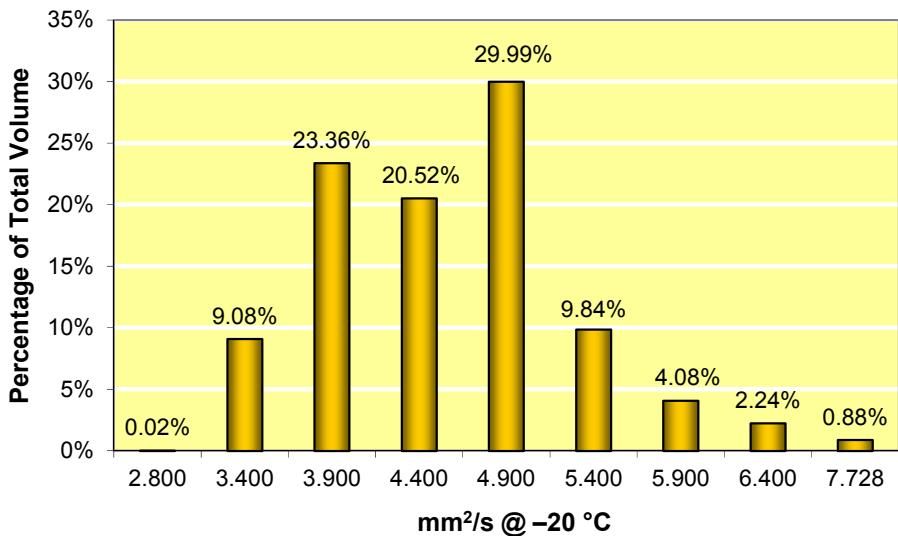


Figure 4-22: Viscosity (mm<sup>2</sup>/s @ -20 °C), maximum 8.0

## 4. JP8 Data

### Freezing Point—2013

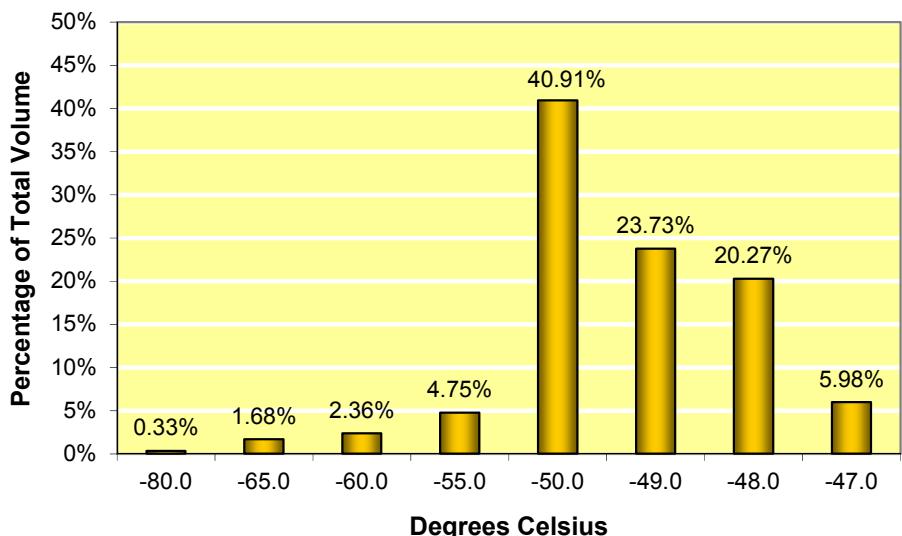


Figure 4-23: Freezing Point (°C), maximum –47

### Freezing Point 13-Year Trend—Weighted Mean

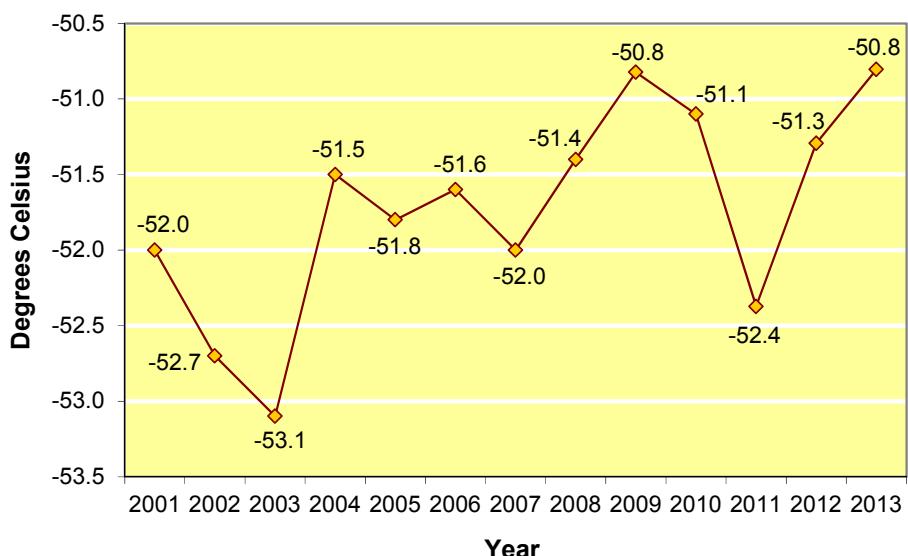


Figure 4-24: Freezing Point (°C), 13-Year Trend, maximum –47

## Net Heat of Combustion—2013

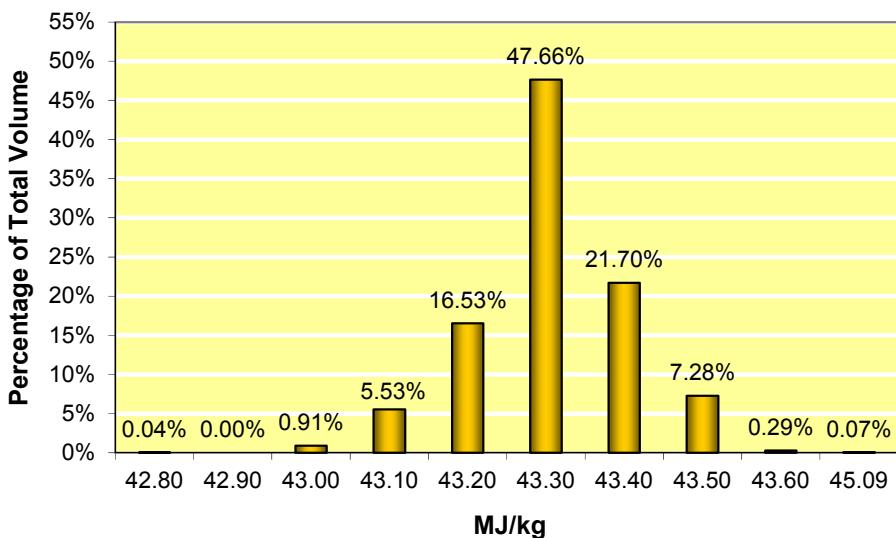


Figure 4-25: Net Heat of Combustion (MJ/kg), minimum 42.8

## Net Heat of Combustion 13-Year Trend—Weighted Mean

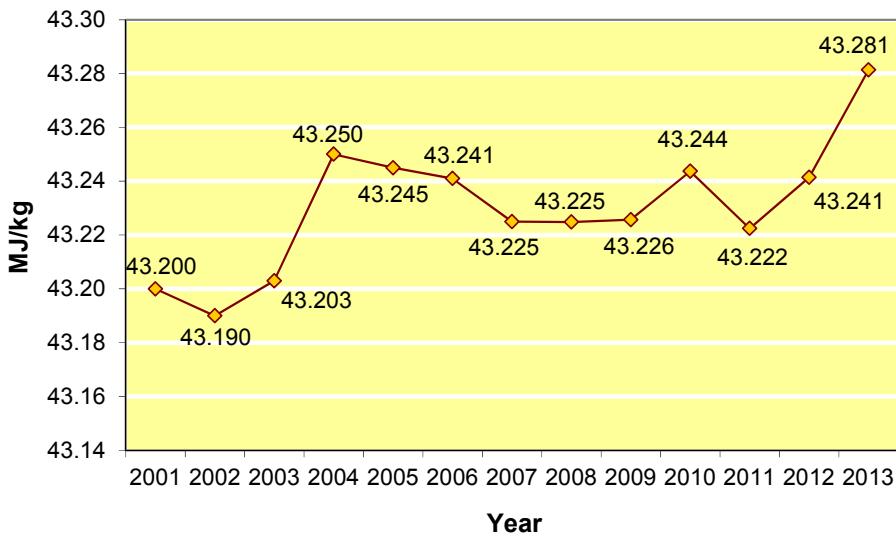


Figure 4-26: Net Heat of Combustion (MJ/kg), 13-Year Trend, minimum 42.8

## 4. JP8 Data

### Calculated Cetane Index—2013

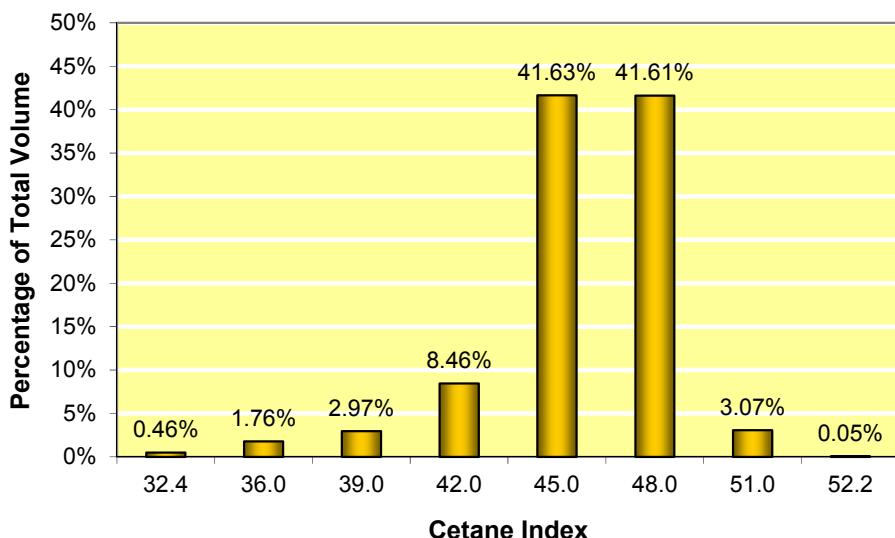


Figure 4-27: Calculated Cetane Index, Report

### Calculated Cetane Index 13-Year Trend—Weighted Mean

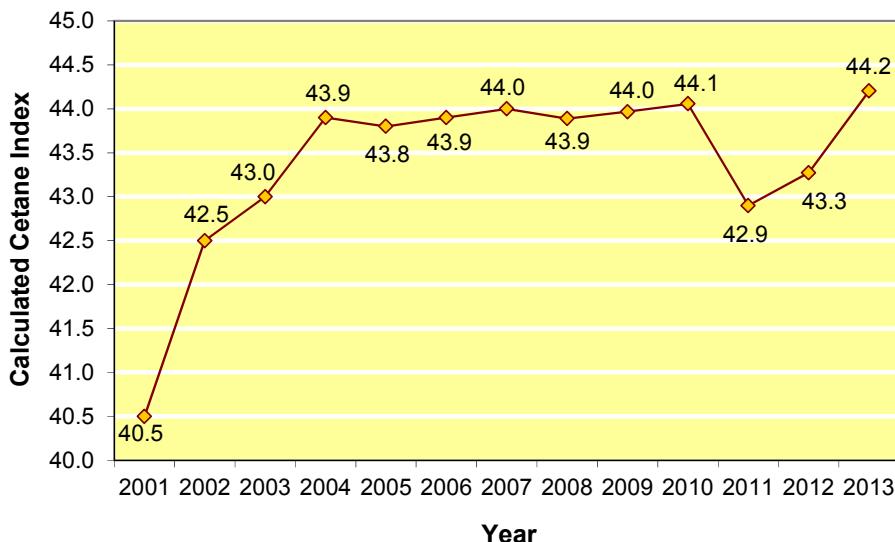


Figure 4-28: Calculated Cetane Index, 13-Year Trend, Report

## Hydrogen Content—2013

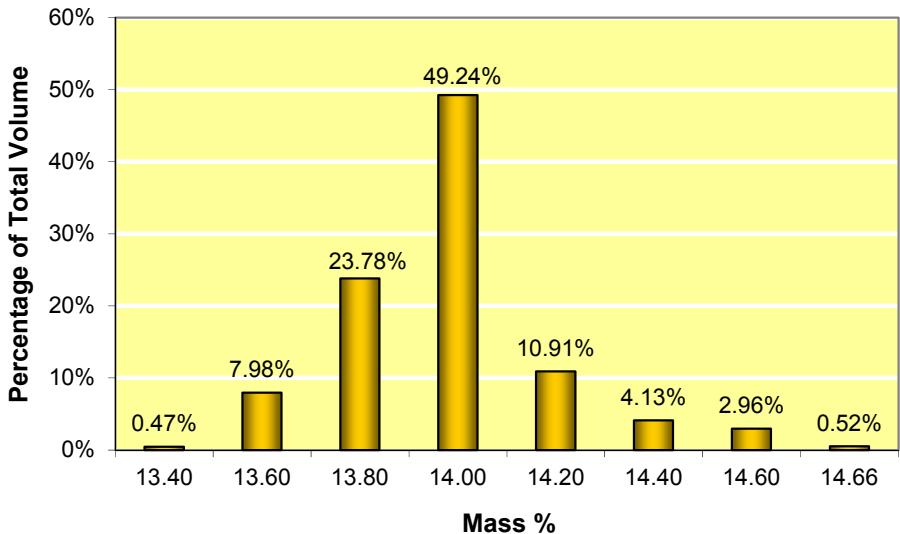


Figure 4-29: Hydrogen Content (mass %), minimum 13.4

## Smoke Point—2013

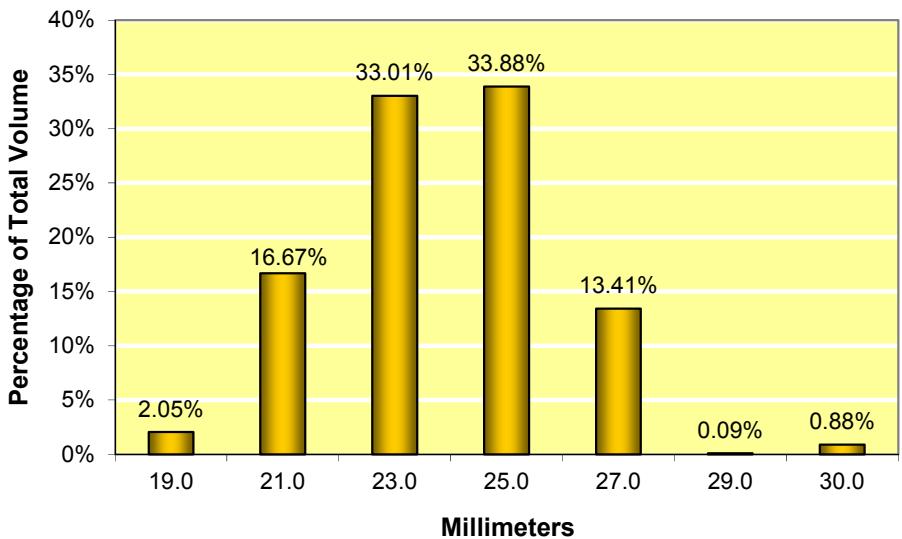


Figure 4-30: Smoke Point (mm), minimum 25.0

## 4. JP8 Data

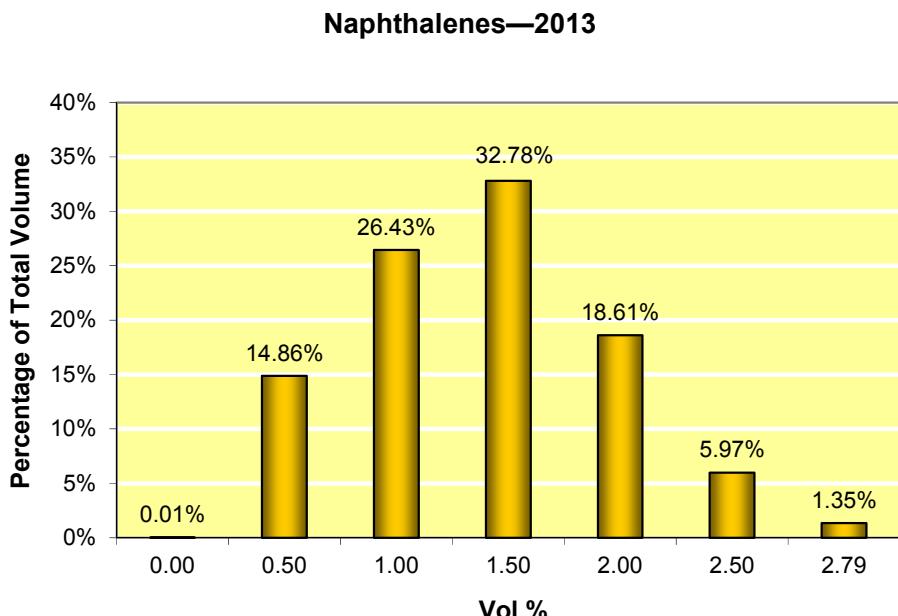


Figure 4-31: Naphthalenes (vol %), maximum 3.0

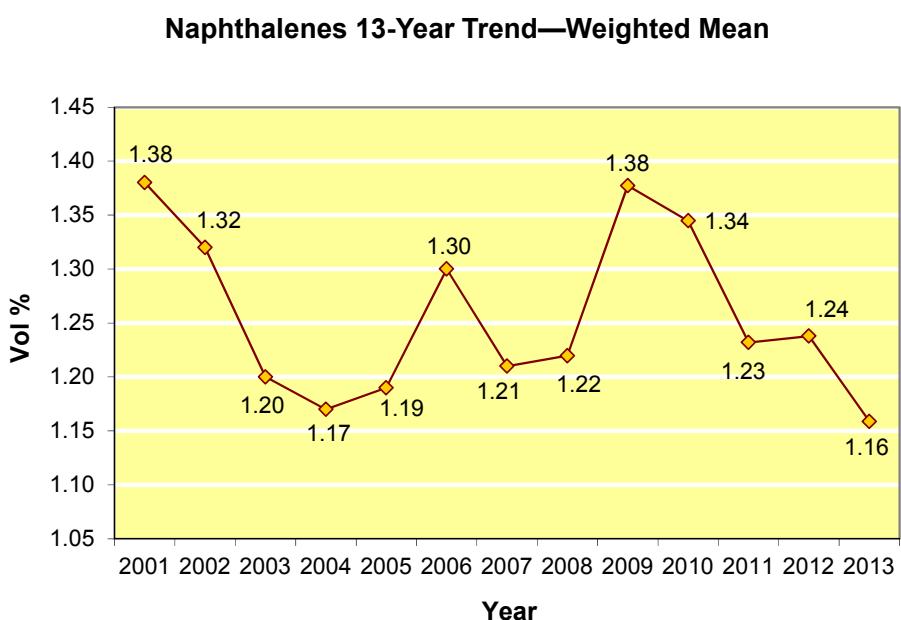


Figure 4-32: Naphthalenes (vol %), 13-Year Trend, maximum 3.0

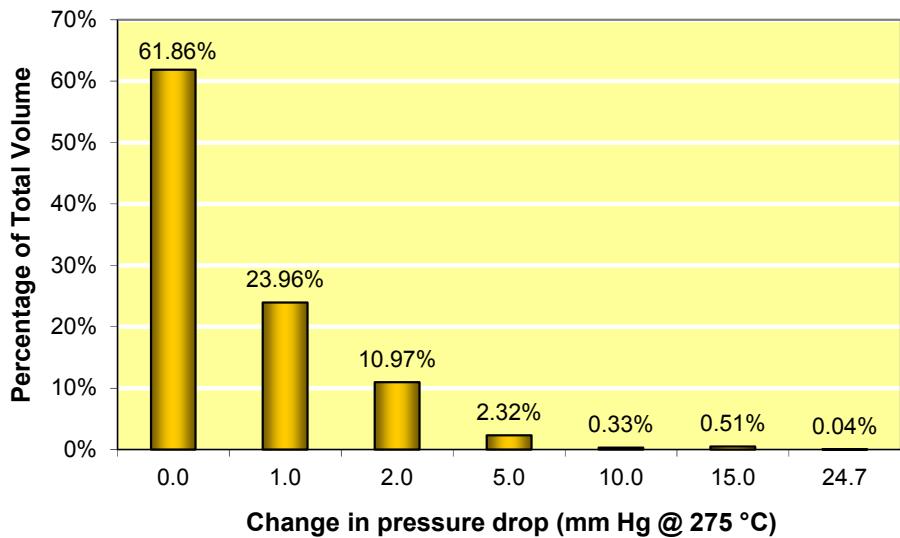
**Thermal Stability (JFTOT @ 275 °C)—2013**

Figure 4-33: Thermal Stability, Change in Pressure Drop (mm Hg @ 275 °C), maximum 25

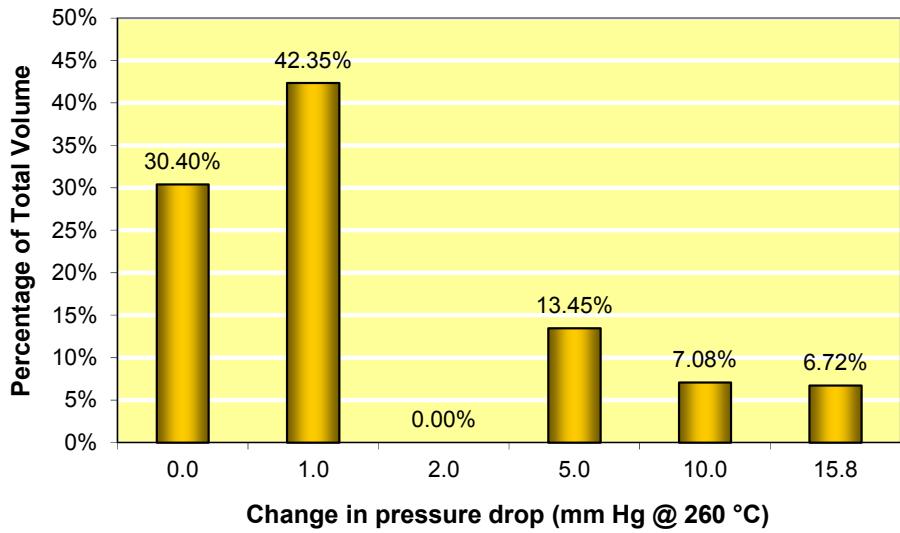
**Thermal Stability (JFTOT @ 260 °C)—2013**

Figure 4-34: Thermal Stability, Change in Pressure Drop (mm Hg @ 260 °C), maximum 25

## 4. JP8 Data

### Existent Gum—2013

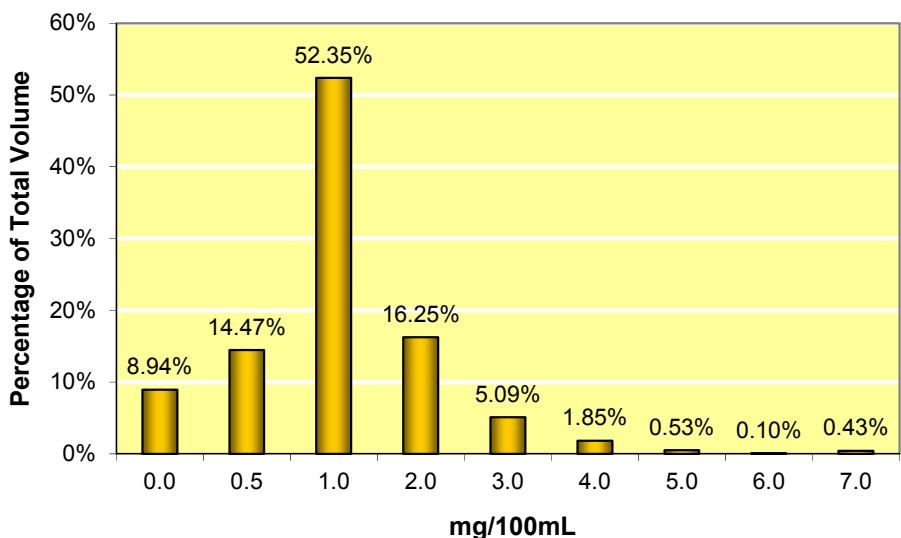


Figure 4-35: Existent Gum (mg/100 mL), maximum 7.0



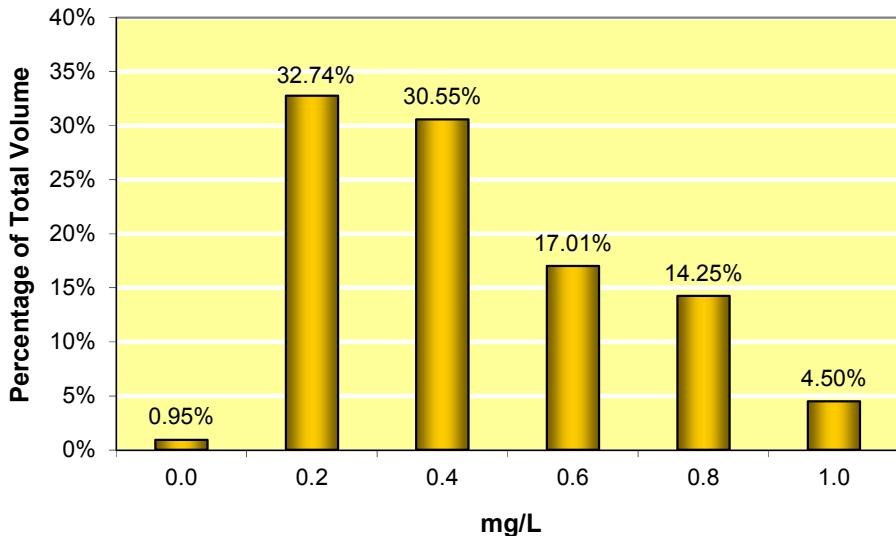
**Particulate Matter—2013**

Figure 4-36: Particulate Matter (mg/L), maximum 1.0

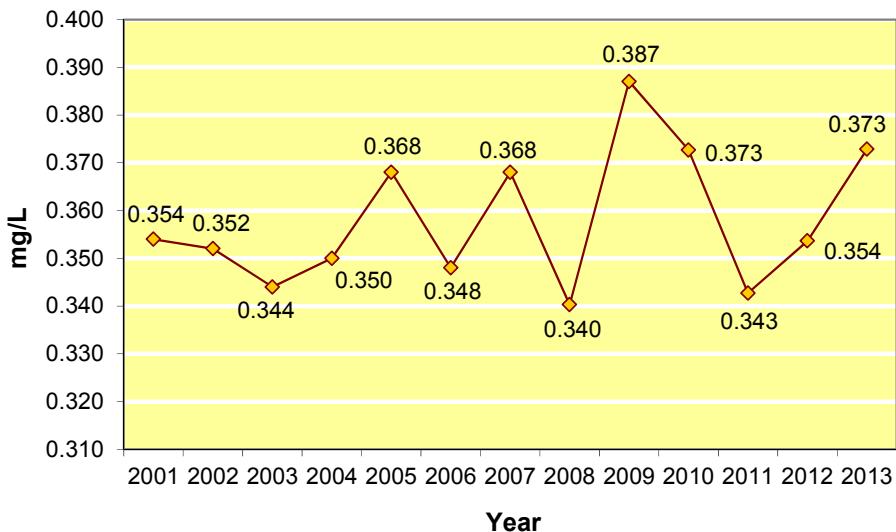
**Particulate Matter 13-Year Trend—Weighted Mean**

Figure 4-37: Particulate Matter (mg/L), 13-Year Trend, maximum 1.0

## 4. JP8 Data

Filtration Time—2013

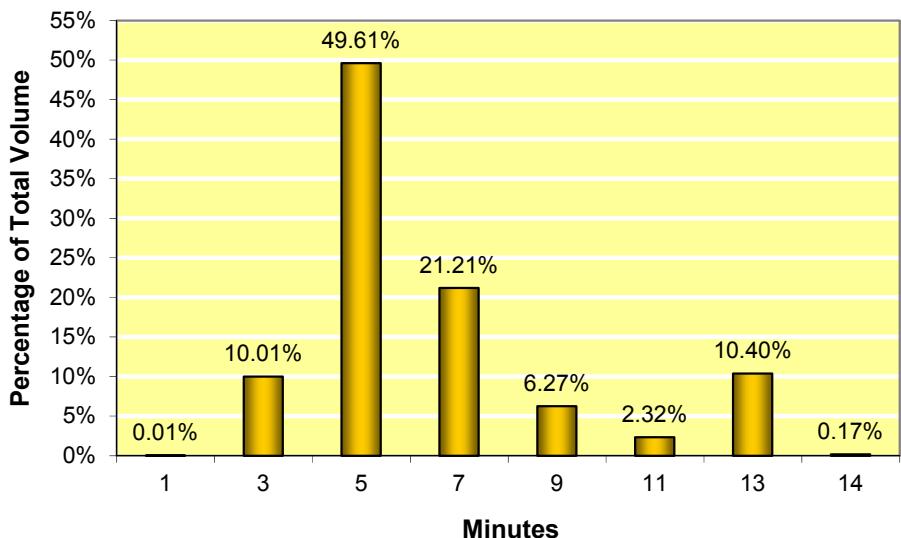


Figure 4-38: Filtration Time (minutes), maximum 15

Microseparometer—2013

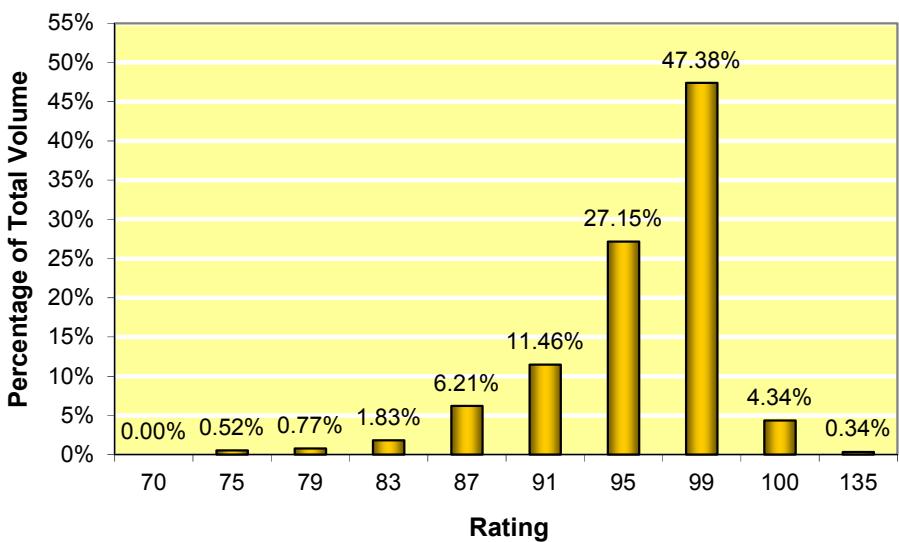


Figure 4-39: Microseparometer (rating), minimum 70

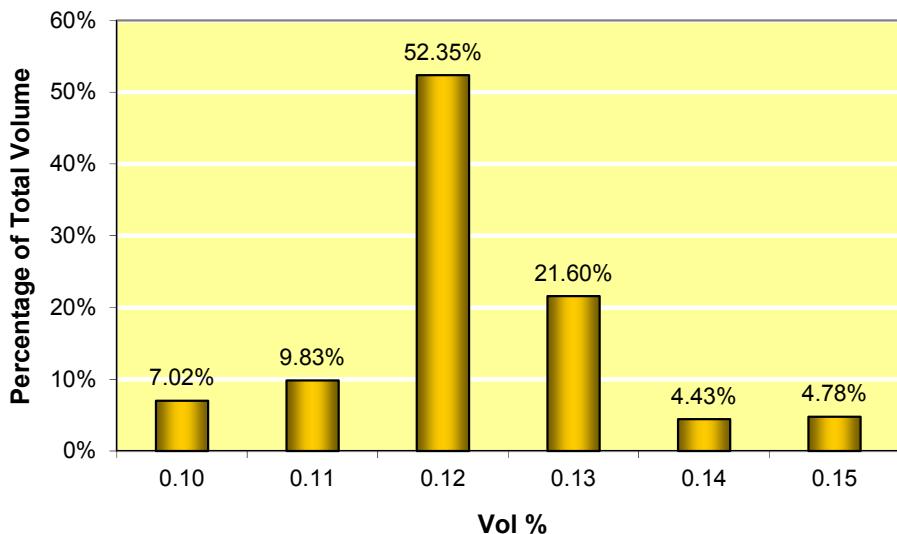
**Fuel System Icing Inhibitor—2013**

Figure 4-40: Fuel System Icing Inhibitor (vol %), minimum 0.07, maximum 0.10

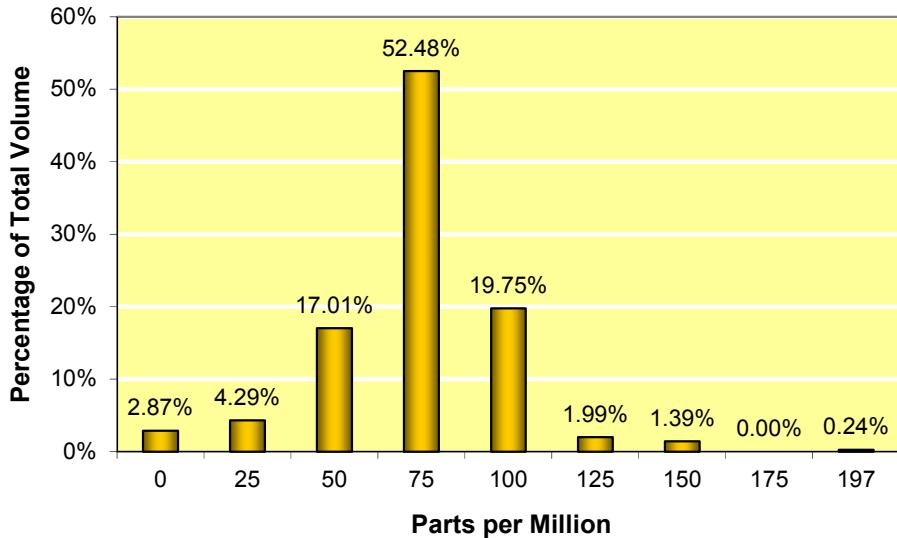
**Water Content—2013**

Figure 4-41: Water Content—2013

## 4. JP8 Data

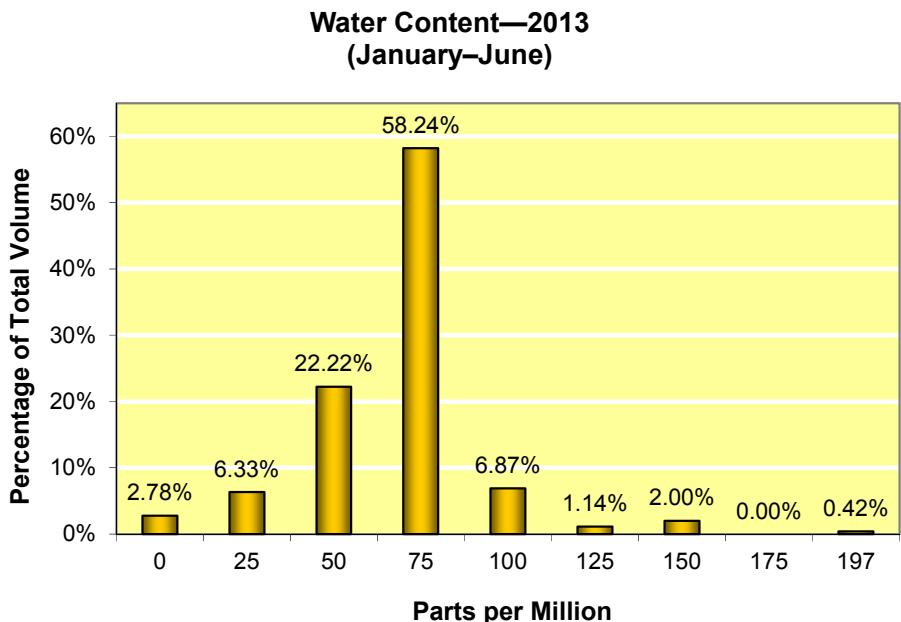


Figure 4-42: Water Content, January–June 2013

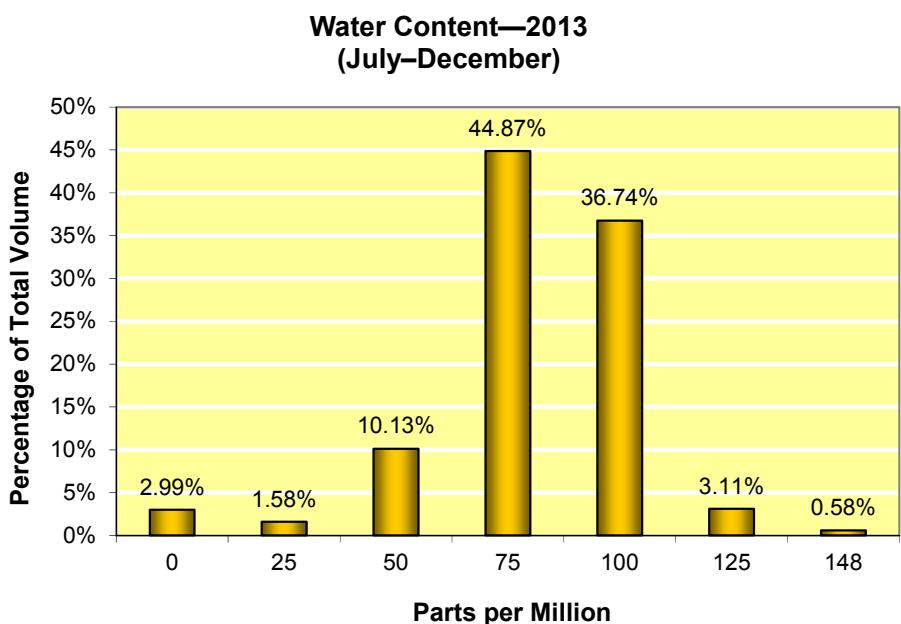


Figure 4-43: Water Content, July–December 2013



## 5. JP5–2013 Data Summary

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44)			
Property	2013 Source Inputs		
	Region	Volume	Analysis
<b>Total Acid Number:</b> (mg KOH/g)	All	359.32	205
<b>Aromatics:</b> (vol %)	All	359.32	207
<b>Sulfur, Total:</b> (mass %)	All	359.32	207
<b>Sulfur, Mercaptan:</b> (mass %)	All	293.59	106
<b>Distillation Temperature:</b>			
Initial Boiling Point, (°C)	All	359.32	208
10% Recovered, (°C)	All	359.32	208
20% Recovered, (°C)	All	359.32	208
50% Recovered, (°C)	All	359.32	208
90% Recovered, (°C)	All	359.32	208
End Point, (°C)	All	359.32	208
Residue, (vol %)	All	146.82	133
Loss, (vol %)	All	146.82	132
<b>Flash Point:</b> (°C)	All	359.32	212
<b>Density:</b> (kg/L @ 15 °C)	All	359.32	207
<b>Density:</b> (API @ 15 °C)	All	327.87	198
<b>Freezing Point:</b> (°C)	All	356.91	205
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)	All	359.32	207
<b>Heating Value, Heat of combustion:</b> (MJ/kg)	All	359.32	207
<b>Smoke Point:</b> (mm)	All	359.32	207
<b>Cetane Index:</b> (calculated)	All	349.79	203
<b>Hydrogen Content:</b> (mass %)	All	354.54	202
<b>Thermal Stability:</b>			
Change in pressure drop, mm Hg @ 275 °C	All	358.02	205
<b>Existent Gum:</b> (mg/100 mL)	All	359.32	176
<b>Particulate Matter:</b> (mg/L)	All	359.32	204
<b>Filtration Time:</b> (minutes)	All	359.32	208
<b>MSEP:</b> (rating)	All	359.32	207
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	All	77.06	27

Table 5-1: Data Summary, MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44), 2013 Source Inputs

## 5. JP5–2013 Data Summary

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0006	0.0200	0.0046	0.0044
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.3	21.5	18.56	18.70
<b>Sulfur, Total:</b> (mass %)		<b>0.20</b>	0.0009	0.2000	0.082	0.111
<b>Sulfur, Mercaptan:</b> <sup>1</sup> (mass %)		<b>0.002</b>	0.0000	0.0018	0.0013	0.0013
<b>Distillation Temperature:</b>						
Initial Boiling Point, (°C)		<b>Report</b>	137.0	189.0	166.3	158.3
10% Recovered, (°C)		<b>205</b>	168.0	198.0	185.9	180.7
20% Recovered, (°C)		<b>Report</b>	174.3	207.0	194.3	190.0
50% Recovered, (°C)		<b>Report</b>	199.1	228.0	213.9	211.2
90% Recovered, (°C)		<b>Report</b>	217.5	258.9	243.5	243.7
End Point, (°C)		<b>300</b>	229.8	284.6	264.1	264.8
Residue, (vol %)		<b>1.5</b>	0.1	1.4	0.9	1.0
Loss, (vol %)		<b>1.5</b>	0.2	1.5	0.9	0.9
<b>Flash Point:</b> (°C)	<b>60</b>		60.0	69.0	62.4	63.3
<b>Density:</b> (kg/L @ 15 °C)	<b>0.788</b>	<b>0.845</b>	0.7973	0.8336	0.8145	0.8092
<b>Density:</b> (API @ 15 °C)	<b>36.0</b>	<b>48.0</b>	38.20	45.90	42.05	43.37
<b>Freezing Point:</b> (°C)		<b>-46</b>	-80.0	-46.8	-50.4	-50.7
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.5</b>	3.799	7.290	5.291	4.917
<b>Heating Value, Heat of combustion:</b> (MJ/kg)	<b>42.6</b>		42.980	43.350	43.130	43.165
<b>Smoke Point:</b> (mm)	<b>19.0</b>		20.0	25.0	21.4	22.2
<b>Cetane Index:</b> (calculated)		<b>Report</b>	36.50	48.52	44.1	45.2
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.40	15.10	13.93	14.09
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C		<b>25</b>	0.00	3.00	0.23	0.25
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.0	4.0	1.16	1.17
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.00	0.84	0.16	0.20
<b>Filtration Time:</b> (minutes)		<b>15</b>	2	7	3.38	3.30
<b>MSEP:</b> (rating)	<b>70</b>		<b>71</b>	<b>100</b>	<b>92.5</b>	<b>89.5</b>
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.10</b>	<b>0.15</b>	0.100	0.140	0.117	0.117

Table 5-2: Data Summary, MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44), 2013 Test Results

**Note 1:** The sulfur mercaptan limit or negative doctor test result is acceptable to meet the specification requirement.

## 5. JP5–2013 Regional Data Summary

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44)						
Property	Total Volume		212.50			
	Batch Analysis		73			
	Specification Limits		Region 3			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0030	0.0100	0.0052	0.0052
<b>Aromatics:</b> (vol %)		<b>25.0</b>	16.8	20.9	18.73	18.73
<b>Sulfur, Total:</b> (mass %)		<b>0.20</b>	0.0814	0.1912	0.144	0.144
<b>Sulfur, Mercaptan:</b> (mass %)		<b>0.002</b>	0.0007	0.0018	0.0015	0.0015
<b>Distillation Temperature:</b>						
Initial Boiling Point, (°C)		<b>Report</b>	137.0	151.0	143.5	143.6
10% Recovered, (°C)		<b>205</b>	168.0	177.0	172.4	172.5
20% Recovered, (°C)		<b>Report</b>	180.0	191.0	184.6	184.7
50% Recovered, (°C)		<b>Report</b>	207.0	217.0	211.4	211.4
90% Recovered, (°C)		<b>Report</b>	243.0	256.0	249.2	249.3
End Point, (°C)		<b>300</b>	266.0	284.0	270.5	270.4
Residue, (vol %)		<b>1.5</b>	NR	NR	NR	NR
Loss, (vol %)		<b>1.5</b>	NR	NR	NR	NR
<b>Flash Point:</b> (°C)	<b>60</b>		62.0	67.0	63.9	64.0
<b>Density:</b> (kg/L @ 15 °C)	<b>0.788</b>	<b>0.845</b>	0.8017	0.8119	0.8066	0.8065
<b>Density:</b> (API @ 15 °C)	<b>36.0</b>	<b>48.0</b>	42.60	44.60	43.76	43.77
<b>Freezing Point:</b> (°C)		<b>-46</b>	-55.5	-47.1	-48.4	-48.4
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.5</b>	4.211	5.708	4.837	4.834
<b>Heating Value, Heat of combustion:</b> (MJ/kg)	<b>42.6</b>		43.064	43.251	43.179	43.181
<b>Smoke Point:</b> (mm)	<b>19.0</b>		20.0	25.0	22.5	22.5
<b>Cetane Index:</b> (calculated)		<b>Report</b>	39.78	48.52	46.1	46.1
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.81	15.10	14.31	14.31
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C		<b>25</b>	0.00	2.40	0.07	0.05
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	1.0	4.0	1.27	1.26
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.03	0.47	0.12	0.12
<b>Filtration Time:</b> (minutes)		<b>15</b>	2	4	2.92	2.91
<b>MSEP:</b> (rating)	<b>70</b>		76	98	87.8	87.5
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.10</b>	<b>0.15</b>	NR	NR	NR	NR

Table 5-3: Region 3 Summary

## 5. JP5–2013 Regional Data Summary

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44)						
Property	Total Volume		66.78			
	Batch Analysis		106			
	Specification Limits		Region 5			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0006	0.0110	0.0041	0.0030
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.3	20.2	18.21	17.92
<b>Sulfur, Total:</b> (mass %)		<b>0.20</b>	0.0100	0.1300	0.039	0.027
<b>Sulfur, Mercaptan:</b> (mass %)		<b>0.002</b>	0.0000	0.0010	0.0005	0.0006
<b>Distillation Temperature:</b>						
Initial Boiling Point, (°C)	<b>Report</b>		175.0	182.0	178.9	179.4
10% Recovered, (°C)	<b>205</b>		192.0	198.0	194.1	193.7
20% Recovered, (°C)	<b>Report</b>		198.0	207.0	201.1	200.7
50% Recovered, (°C)	<b>Report</b>		212.0	228.0	218.1	217.1
90% Recovered, (°C)	<b>Report</b>		231.0	257.0	242.5	240.5
End Point, (°C)	<b>300</b>		250.0	275.0	263.1	261.8
Residue, (vol %)	<b>1.5</b>		0.1	1.2	0.9	0.9
Loss, (vol %)	<b>1.5</b>		0.2	1.5	0.9	0.8
<b>Flash Point:</b> (°C)	<b>60</b>		60.0	63.0	61.0	61.0
<b>Density:</b> (kg/L @ 15 °C)	<b>0.788</b>	<b>0.845</b>	0.8112	0.8336	0.8217	0.8205
<b>Density:</b> (API @ 15 °C)	<b>36.0</b>	<b>48.0</b>	38.20	42.80	40.60	40.89
<b>Freezing Point:</b> (°C)		<b>–46</b>	–55.0	–47.0	–49.4	–49.5
<b>Viscosity:</b> (mm <sup>2</sup> /s @ –20 °C)		<b>8.5</b>	5.180	7.290	5.830	5.689
<b>Heating Value, Heat of combustion:</b> (MJ/kg)	<b>42.6</b>		43.000	43.200	43.087	43.100
<b>Smoke Point:</b> (mm)	<b>19.0</b>		20.0	22.0	20.3	20.3
<b>Cetane Index:</b> (calculated)	<b>Report</b>		41.10	45.10	42.9	43.0
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.40	14.10	13.69	13.72
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C	<b>25</b>		0.00	1.00	0.22	0.37
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.0	3.6	1.09	1.05
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.00	0.50	0.08	0.08
<b>Filtration Time:</b> (minutes)		<b>15</b>	3	4	3.39	3.45
<b>MSEP:</b> (rating)	<b>70</b>		82	100	97.4	97.8
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.10</b>	<b>0.15</b>	NR	NR	NR	NR

Table 5-4: Region 5 Summary

## 5. JP5–2013 Regional Data Summary

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44)						
Property	Total Volume		31.45			
	Batch Analysis		15			
	Specification Limits		Region 7			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0020	0.0080	0.0034	0.0030
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.6	21.5	19.74	20.00
<b>Sulfur, Total:</b> (mass %)		<b>0.20</b>	0.0009	0.0200	0.010	0.008
<b>Sulfur, Mercaptan:</b> (mass %)		<b>0.002</b>	0.0001	0.0006	0.0003	0.0003
<b>Distillation Temperature:</b>						
Initial Boiling Point, (°C)		<b>Report</b>	179.5	189.0	183.6	184.2
10% Recovered, (°C)		<b>205</b>	190.2	198.0	193.6	194.3
20% Recovered, (°C)		<b>Report</b>	192.8	202.0	196.6	197.5
50% Recovered, (°C)		<b>Report</b>	199.1	214.0	206.1	207.7
90% Recovered, (°C)		<b>Report</b>	217.5	239.0	229.5	232.2
End Point, (°C)		<b>300</b>	229.8	268.3	247.2	250.8
Residue, (vol %)		<b>1.5</b>	0.5	1.4	1.1	1.1
Loss, (vol %)		<b>1.5</b>	0.2	1.4	0.8	0.8
<b>Flash Point:</b> (°C)	<b>60</b>		62.0	69.0	65.1	65.7
<b>Density:</b> (kg/L @ 15 °C)	<b>0.788</b>	<b>0.845</b>	0.8005	0.8267	0.8150	0.8165
<b>Density:</b> (API @ 15 °C)	<b>36.0</b>	<b>48.0</b>	NR	NR	NR	NR
<b>Freezing Point:</b> (°C)		<b>-46</b>	-80.0	-47.0	-68.3	-72.3
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.5</b>	3.799	6.129	4.615	4.709
<b>Heating Value, Heat of combustion:</b> (MJ/kg)	<b>42.6</b>		43.000	43.350	43.111	43.104
<b>Smoke Point:</b> (mm)	<b>19.0</b>		20.0	25.0	21.9	21.8
<b>Cetane Index:</b> (calculated)		<b>Report</b>	39.50	42.20	40.7	41.0
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.53	13.97	13.74	13.75
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C		<b>25</b>	0.00	3.00	1.07	1.48
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.8	2.0	1.11	1.12
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.20	0.70	0.42	0.46
<b>Filtration Time:</b> (minutes)		<b>15</b>	3	6	4.07	3.84
<b>MSEP:</b> (rating)	<b>70</b>		71	98	87.9	87.3
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.10</b>	<b>0.15</b>	0.110	0.140	0.122	0.125

Table 5-5: Region 7 Summary

## 5. JP5–2013 Regional Data Summary

MIL-DTL-5624 Turbine Fuel, Aviation, Grade JP5 (NATO Code F-44)						
Property	Total Volume		48.59			
	Batch Analysis		14			
	Specification Limits		Region 8			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0020	0.0200	0.0059	0.0043
<b>Aromatics:</b> (vol %)		<b>25.0</b>	17.6	20.9	18.84	18.81
<b>Sulfur, Total:</b> (mass %)		<b>0.20</b>	0.1080	0.2000	0.151	0.148
<b>Sulfur, Mercaptan:</b> (mass %)		<b>0.002</b>	0.0009	0.0016	0.0013	0.0013
<b>Distillation Temperature:</b>						
Initial Boiling Point, (°C)	<b>Report</b>		152.7	179.5	175.7	177.2
10% Recovered, (°C)	<b>205<sup>(186)</sup></b>		168.3	193.0	188.8	190.1
20% Recovered, (°C)	<b>Report</b>		174.3	198.0	192.6	193.8
50% Recovered, (°C)	<b>Report</b>		202.0	215.0	204.9	204.4
90% Recovered, (°C)	<b>Report</b>		225.7	258.9	233.7	231.0
End Point, (°C)	<b>300<sup>(330)</sup></b>		244.8	284.6	255.1	253.5
Residue, (vol %)	<b>1.5</b>		1.0	1.2	1.0	1.0
Loss, (vol %)	<b>1.5</b>		0.8	1.0	1.0	1.0
<b>Flash Point:</b> (°C)	<b>60</b>		61.0	64.0	62.3	62.0
<b>Density:</b> (kg/L @ 15 °C)	<b>0.788</b>	<b>0.845</b>	0.7973	0.8231	0.8039	0.8011
<b>Density:</b> (API @ 15 °C)	<b>36.0</b>	<b>48.0</b>	40.30	45.90	44.46	45.06
<b>Freezing Point:</b> (°C)		<b>-46</b>	-49.0	-46.8	-48.5	-48.6
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.5</b>	4.056	5.870	4.487	4.350
<b>Heating Value, Heat of combustion:</b> (MJ/kg)	<b>42.6</b>		42.980	43.266	43.198	43.226
<b>Smoke Point:</b> (mm)	<b>19.0</b>		20.0	24.0	23.4	23.7
<b>Cetane Index:</b> (calculated)	<b>Report</b>		36.50	46.68	44.8	45.8
<b>Hydrogen Content:</b> (mass %)	<b>13.4</b>		13.79	13.92	13.83	13.84
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C		<b>25</b>	0.00	1.00	0.25	0.23
<b>Existent Gum:</b> (mg/100 mL)		<b>7.0</b>	0.4	1.0	0.94	0.97
<b>Particulate Matter:</b> (mg/L)		<b>1.0</b>	0.11	0.84	0.57	0.56
<b>Filtration Time:</b> (minutes)		<b>15</b>	3	7	4.86	4.44
<b>MSEP:</b> (rating)	<b>70</b>		80	97	88.4	88.6
<b>Fuel System Icing Inhibitor (FSII):</b> (vol %)	<b>0.10</b>	<b>0.15</b>	0.100	0.122	0.111	0.113

Table 5-6: Region 8 Summary

## 5. JP5—Assessment Summary

### ***Overview:***

In 2013, 215 reported analyses, representing 359.32 million U.S. gallons of JP5, were processed by Regions 3, 5, 7, and 8. This represents an increase from the 173 reported JP5 analyses in 2012, but a decrease from the 418.50 million U.S. gallons of JP5 queried from the PQIS in 2012.

### ***Significant Trending:***

**Sulfur, Total.** The weighted mean increased 0.028 mass percent from 2011 to 2013.

**Sulfur, Mercaptan.** The weighted mean increased 0.0002 mass percent from 2011 to 2013.

**Distillation, 10% Recovered.** The weighted mean decreased 5.6 °C from 2011 to 2013 after having increased 3.9 °C from 2008 to 2011.

**Density (kg/L @ 15 °C).** The weighted mean decreased 0.0054 kg/L @ 15 °C from 2011 to 2013.

**Viscosity.** The weighted mean decreased 0.502 mm<sup>2</sup>/s @ -20 °C from 2011 to 2013.

**Cetane Index (Calculated).** The weighted mean increased 0.9 from 2011 to 2013.

**Hydrogen Content.** The weighted mean increased 0.34 mass percent from 2009 to 2013.

### ***JP5 Observations:***

All batches met specification requirements in 2013.

For **Total Acid Number**, a waiver was granted for two Region 8 measurements greater than the maximum specification limit of 0.015 mg KOH/g. These measurements met the specification limit set by the waiver. This measurement is included in the data tables and figures.

## 5. JP5—Assessment Summary

For **MSEP**, all JP5 batches met specification requirements. The impact of additives provides for a wide variation (see Table 5-7). Batches were not separated by type of additives or group of additives for this reporting.

Product	Additives*	MSEP Rating, min
JP-4 and JP-5	Antioxidant (AO)*, Metal Deactivator (MDA)*	90
JP-4 and JP-5	AO*, MDA*, and FSII	85
JP-4 and JP-5	AO*, MDA*, and Corrosion Inhibitor/Lubricity Improver (CI/LI)	80
JP-4 and JP-5	AO*, MDA*, CI/LI, and FSII	70

Table 5-7: JP-4 and JP-5 Additives and Associated MSEP Ratings

\*Even though the presence or absence does not change these limits, samples submitted for specification conformance testing shall contain the same additives present in the refinery batch. Regardless of which minimum the refiner elects to meet, the refiner shall report the MSEP rating on a laboratory hand blend of the fuel with all additives required by the specification.



## 5. JPS Data

**Total Acid Number—2013**

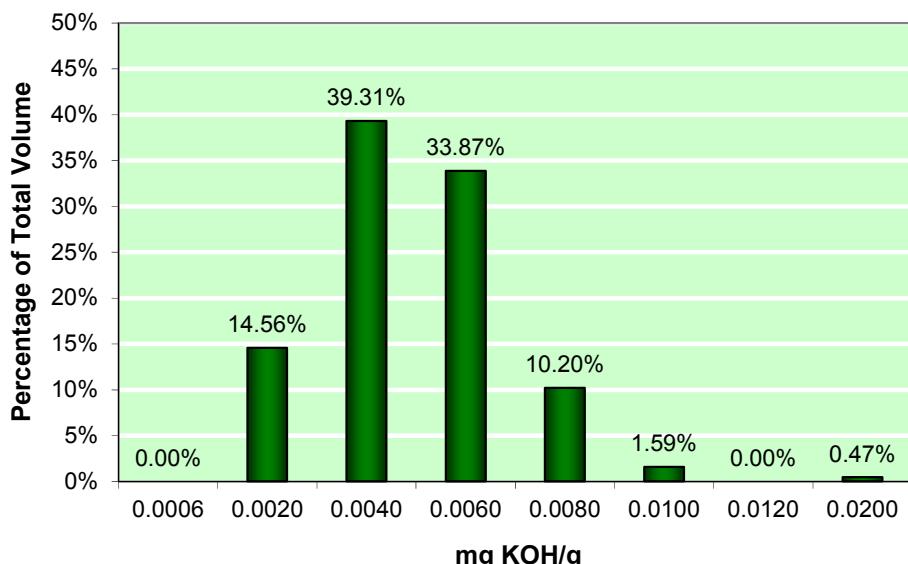


Figure 5-1: Total Acid Number (mg KOH/g), maximum 0.015

**Total Acid Number 13-Year Trend—Weighted Mean**

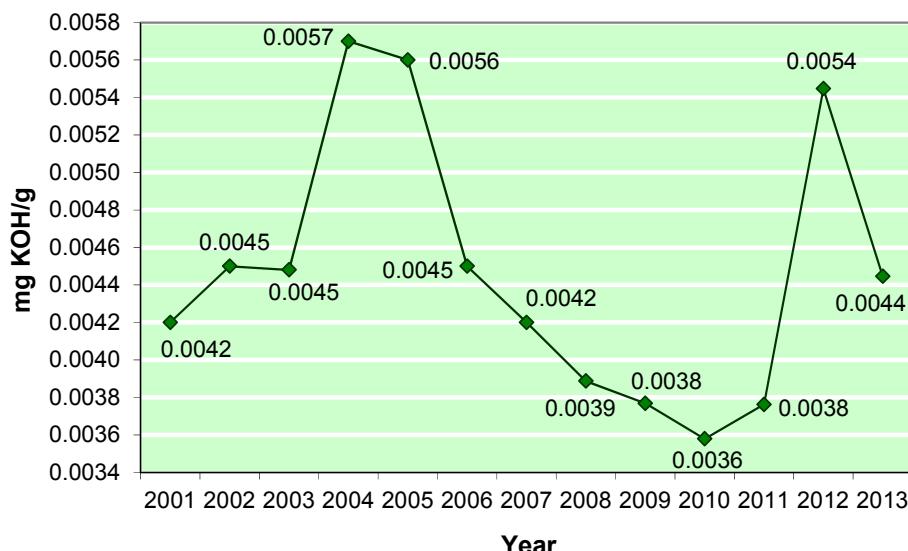


Figure 5-2: Total Acid Number (mg KOH/g), 13-Year Trend, maximum 0.015

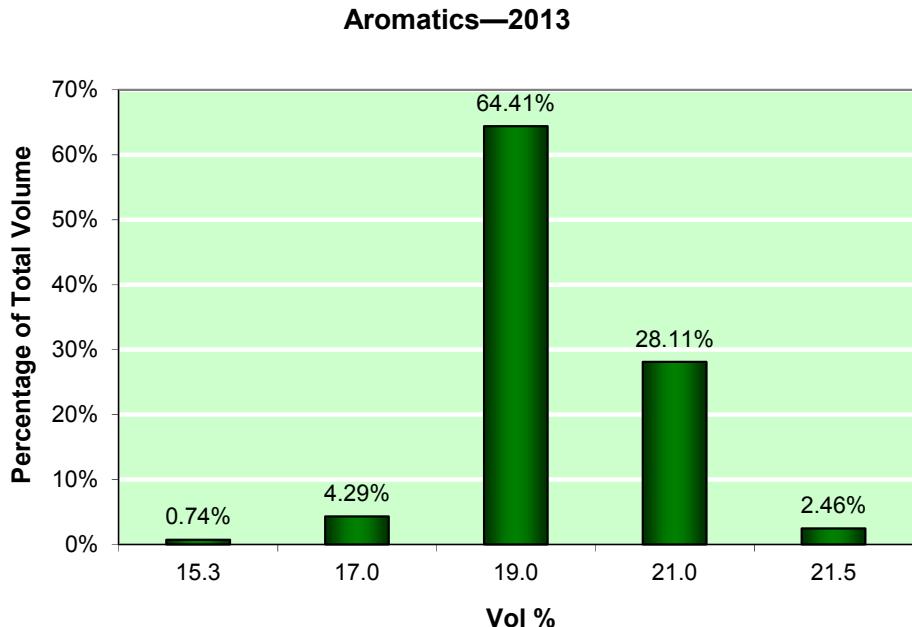


Figure 5-3: Aromatics (vol %), maximum 25.0

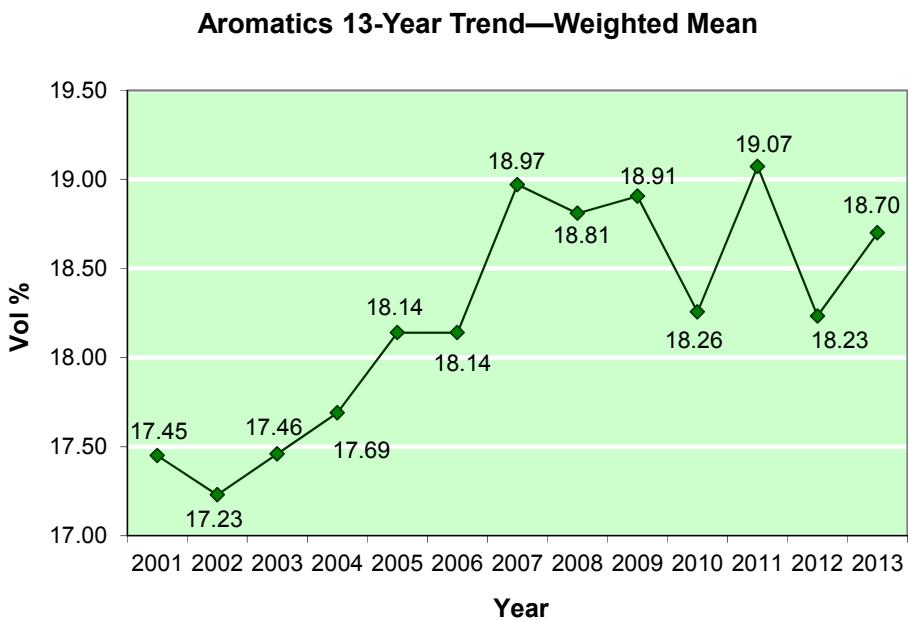


Figure 5-4: Aromatics (vol %), 13-Year Trend, maximum 25.0

## 5. JPS Data

### Sulfur, Total—2013

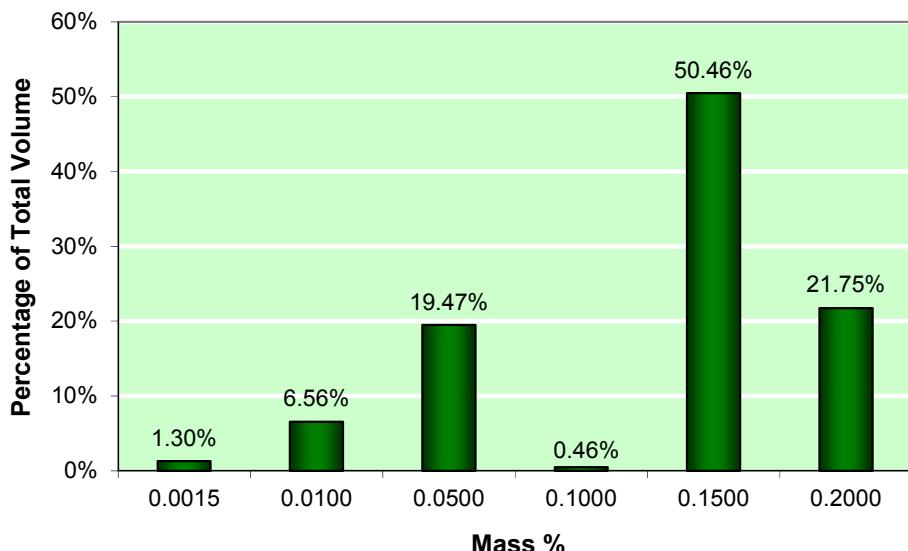


Figure 5-5: Sulfur, Total (mass %), maximum 0.20

### Sulfur, Total 13-Year Trend—Weighted Mean

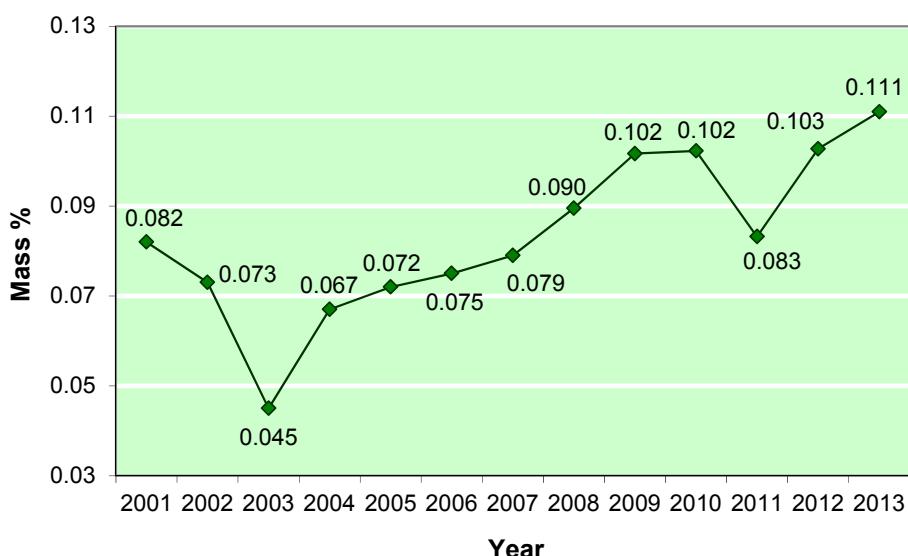


Figure 5-6: Sulfur, Total (mass %), 13-Year Trend, maximum 0.20

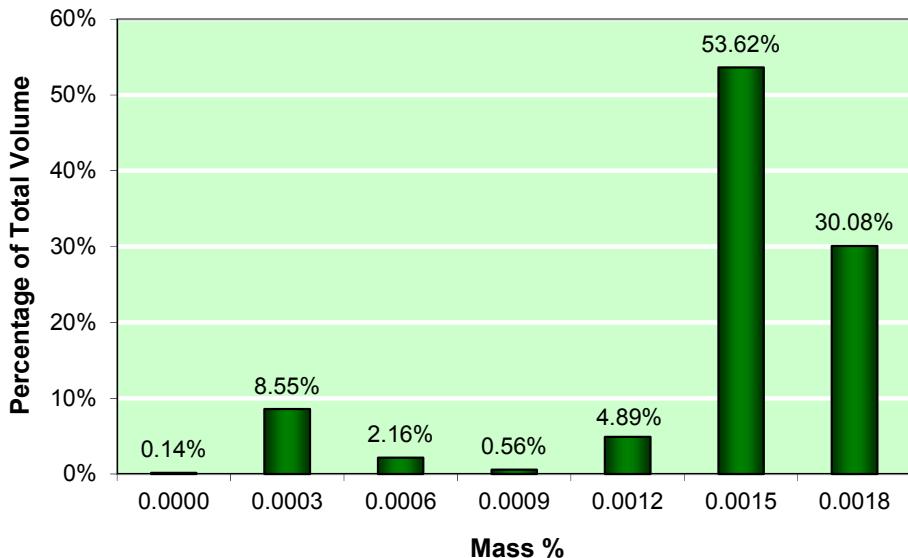
**Sulfur, Mercaptan—2013**

Figure 5-7: Sulfur, Mercaptan (mass %), maximum 0.002

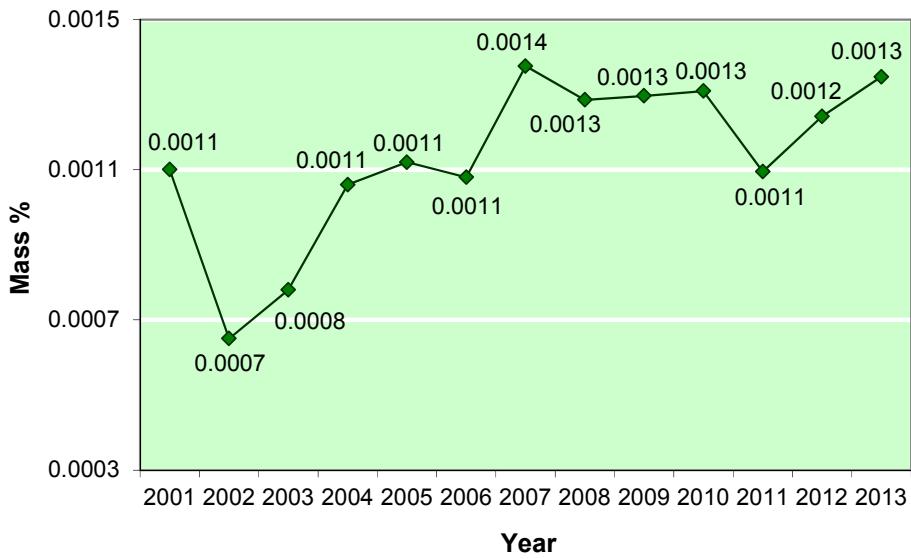
**Sulfur, Mercaptan 13-Year Trend—Weighted Mean**

Figure 5-8: Sulfur, Mercaptan (mass %), 13-Year Trend, maximum 0.002

## 5. JPS Data

### Distillation Initial Boiling Point—2013

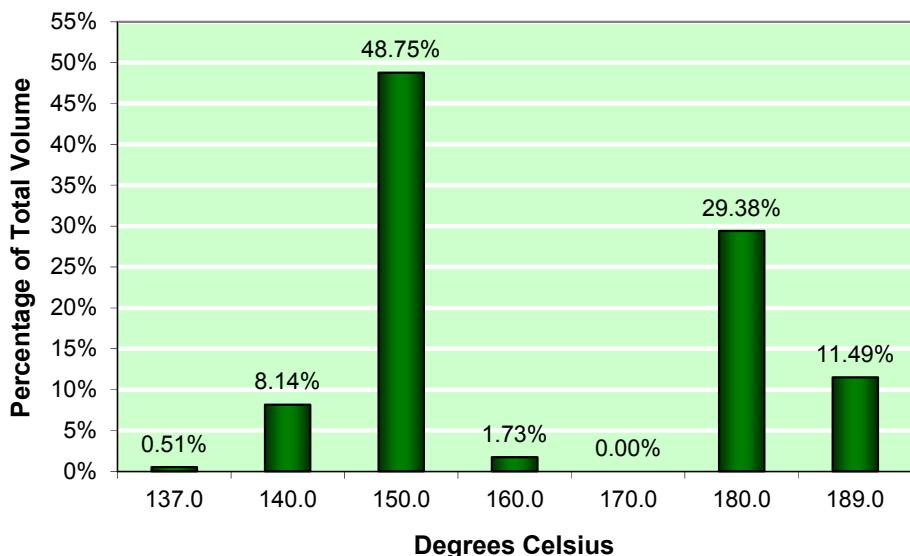


Figure 5-9: Distillation Initial Boiling Point (°C), Report



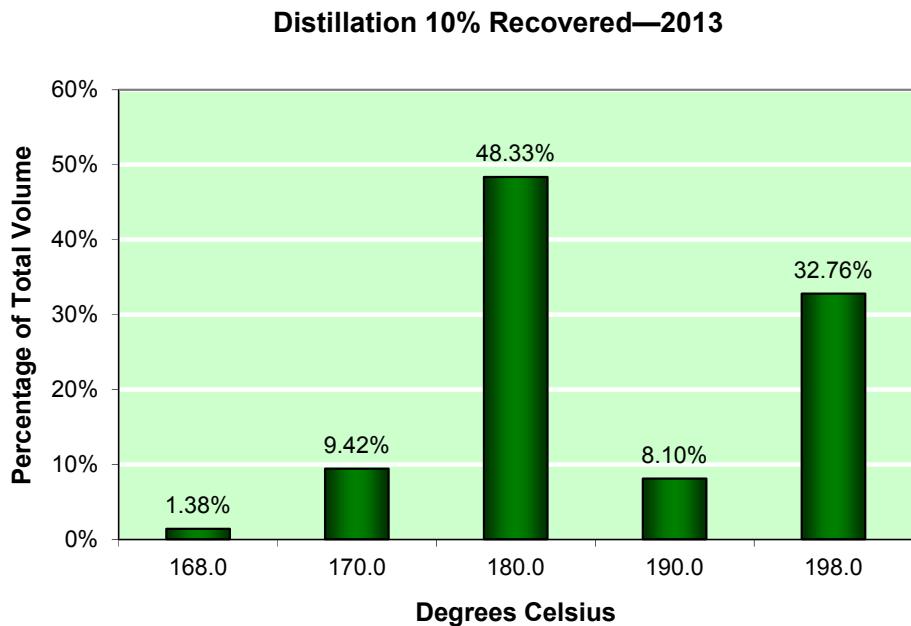


Figure 5-10: Distillation 10% Recovered (°C), maximum 205

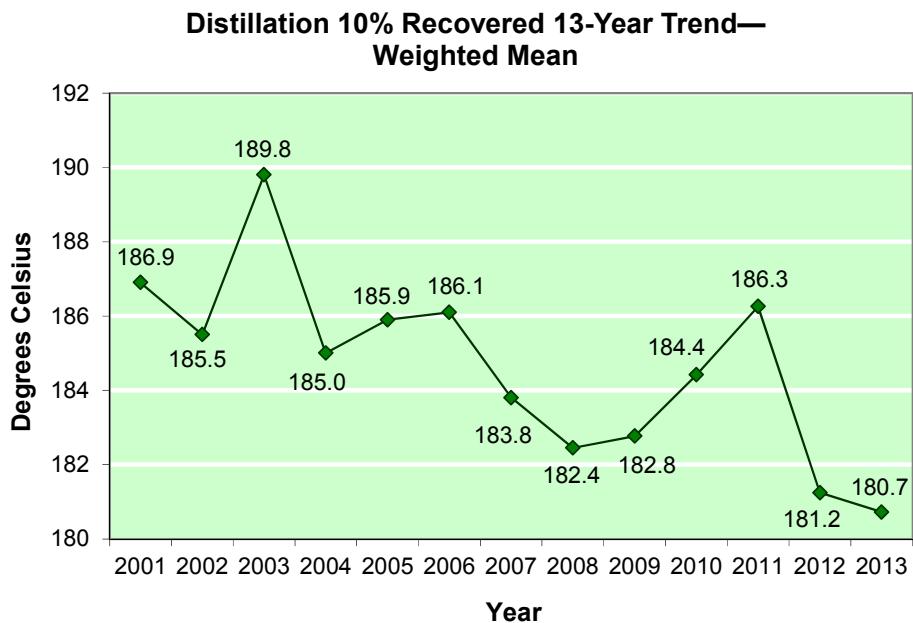


Figure 5-11: Distillation 10% Recovered (°C), 13-Year Trend, maximum 205

## 5. JPS Data

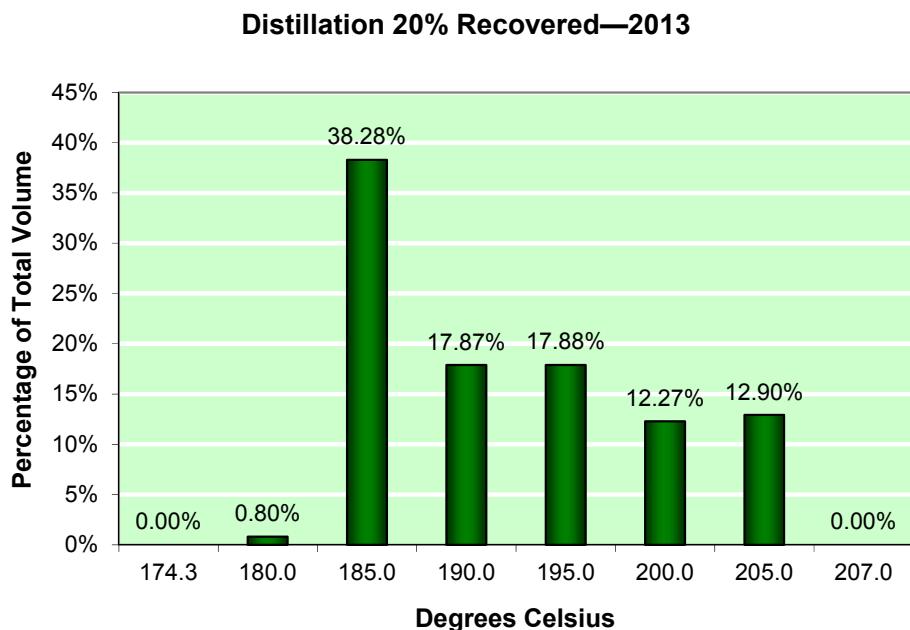


Figure 5-12: Distillation 20% Recovered (°C), Report

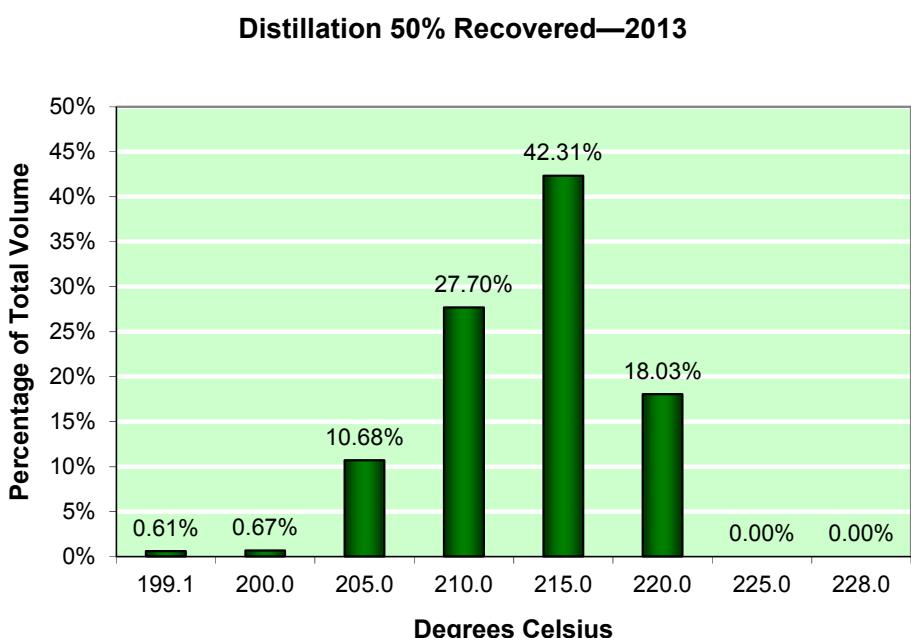


Figure 5-13: Distillation 50% Recovered (°C), Report

### Distillation 90% Recovered—2013

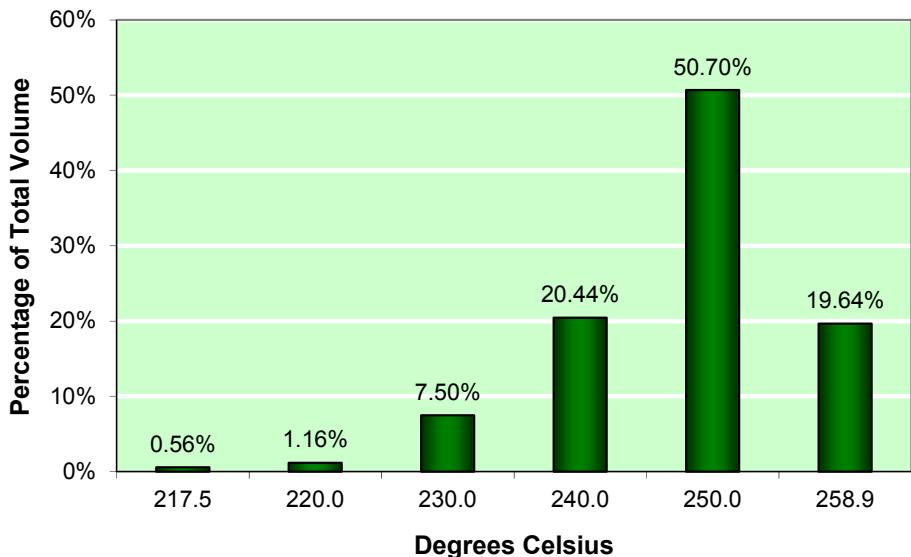


Figure 5-14: Distillation 90% Recovered (°C), Report

### Distillation End Point—2013

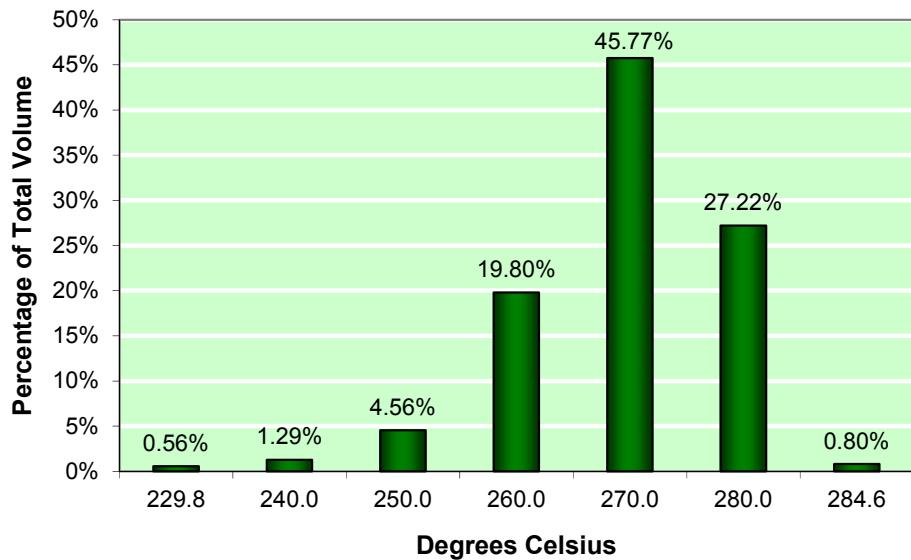


Figure 5-15: Distillation End Point (°C), maximum 300

## 5. JPS Data

Distillation Residue—2013

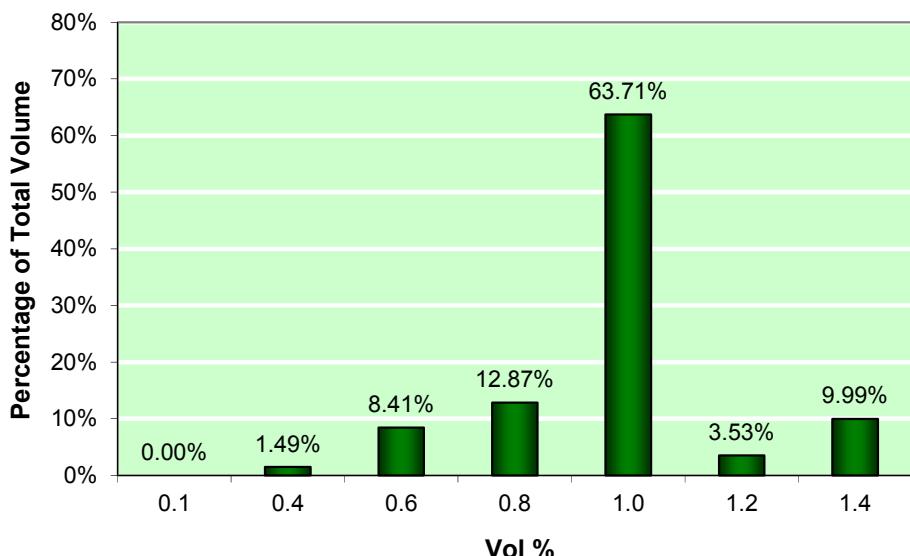


Figure 5-16: Distillation Residue (vol %), maximum 1.5

Distillation Loss—2013

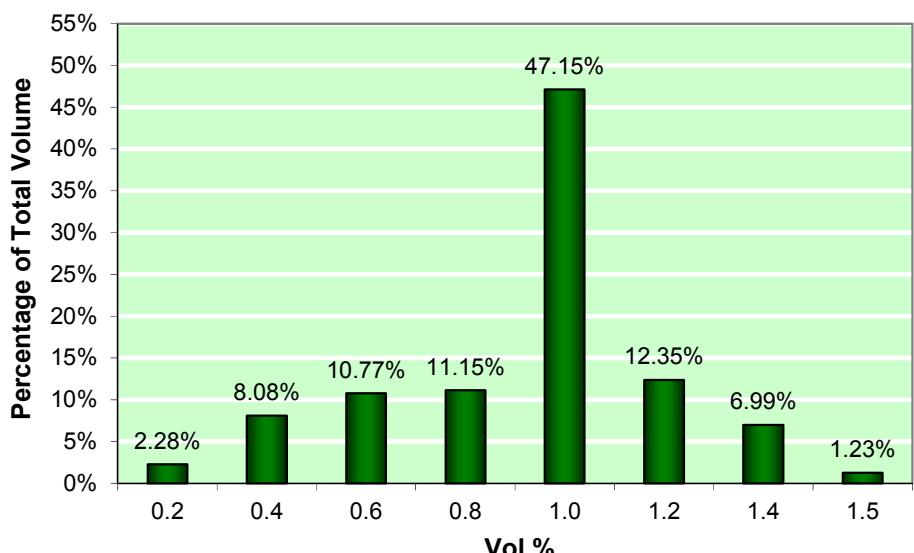


Figure 5-17: Distillation Loss (vol %), maximum 1.5

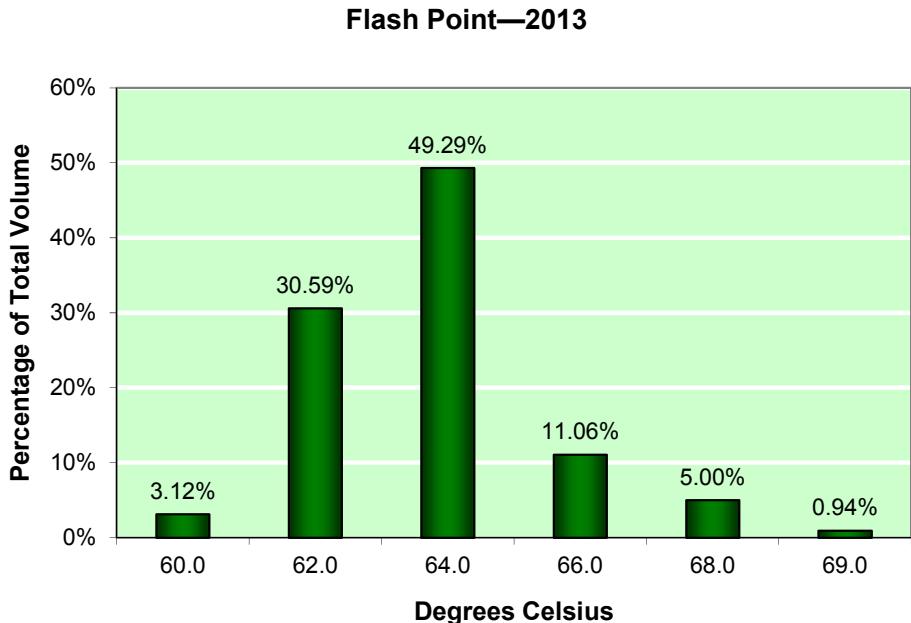


Figure 5-18: Flash Point (°C), minimum 60

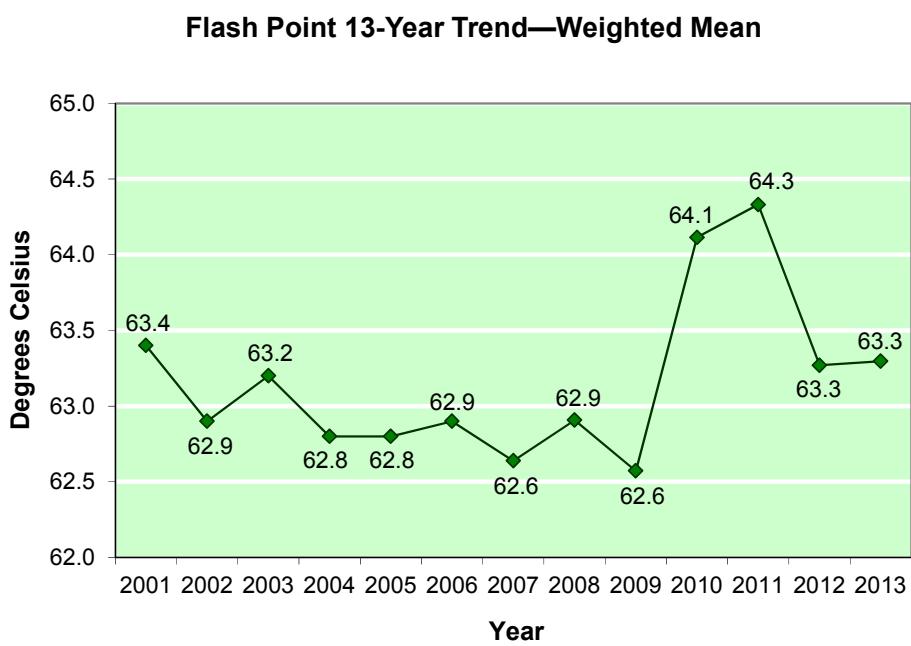


Figure 5-19: Flash Point (°C), 13-Year Trend, minimum 60

## 5. JPS Data

### Density—2013

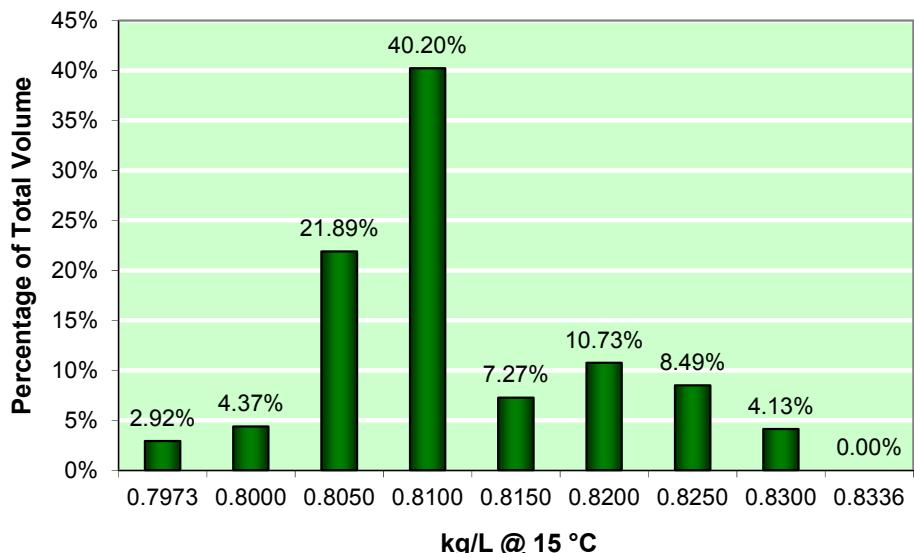


Figure 5-20: Density (kg/L @ 15 °C), minimum 0.788, maximum 0.845

### Density 13-Year Trend—Weighted Mean

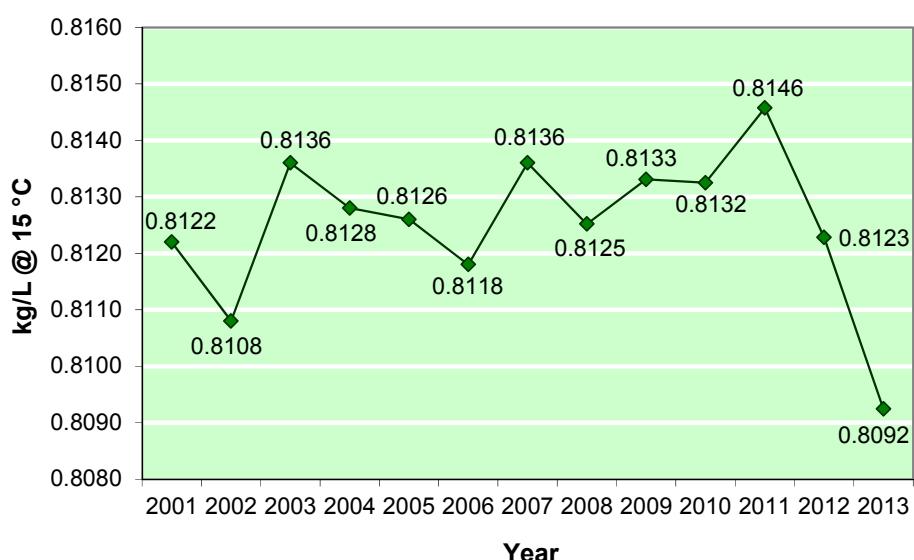


Figure 5-21: Density (kg/L @ 15 °C), 13-Year Trend, minimum 0.788, maximum 0.845

## Density (API)—2013

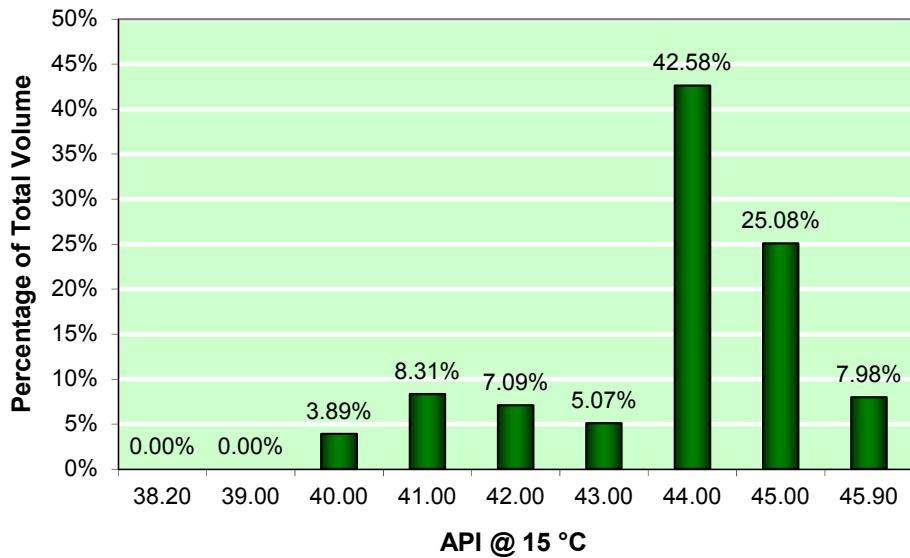


Figure 5-22: Density (API @ 15 °C), minimum 36.0, maximum 48.0

## Freezing Point—2013

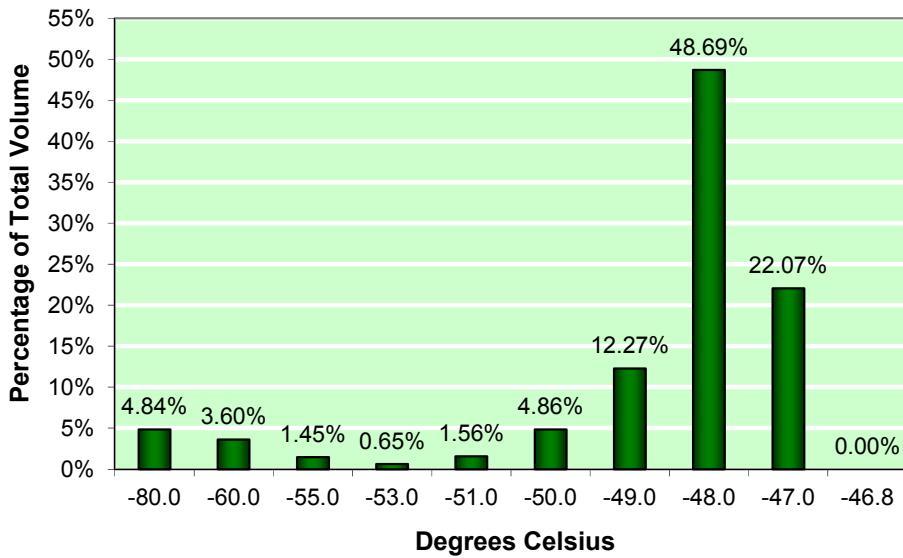


Figure 5-23: Freezing Point (°C), maximum -46

## 5. JPS Data

### Viscosity—2013

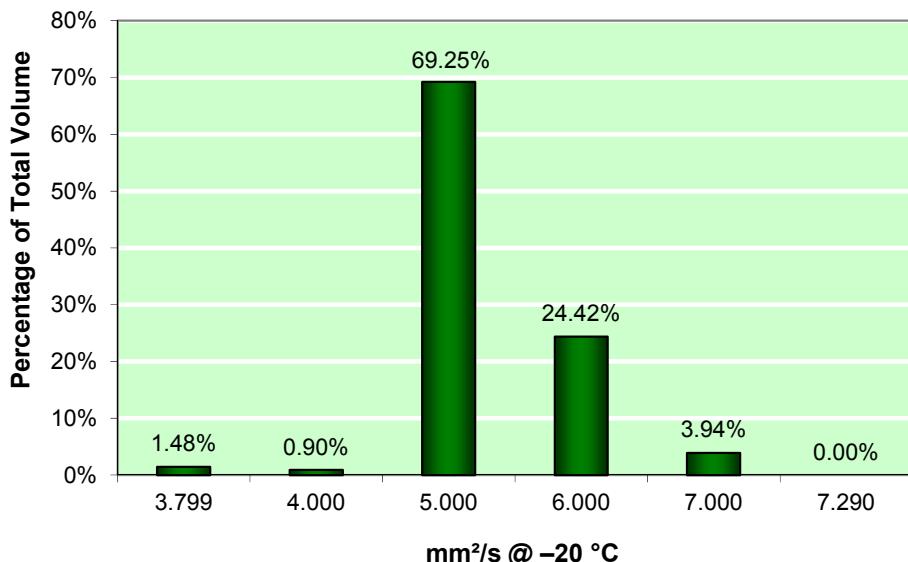


Figure 5-24: Viscosity (mm<sup>2</sup>/s @ -20 °C), maximum 8.5

### Viscosity 13-Year Trend—Weighted Mean

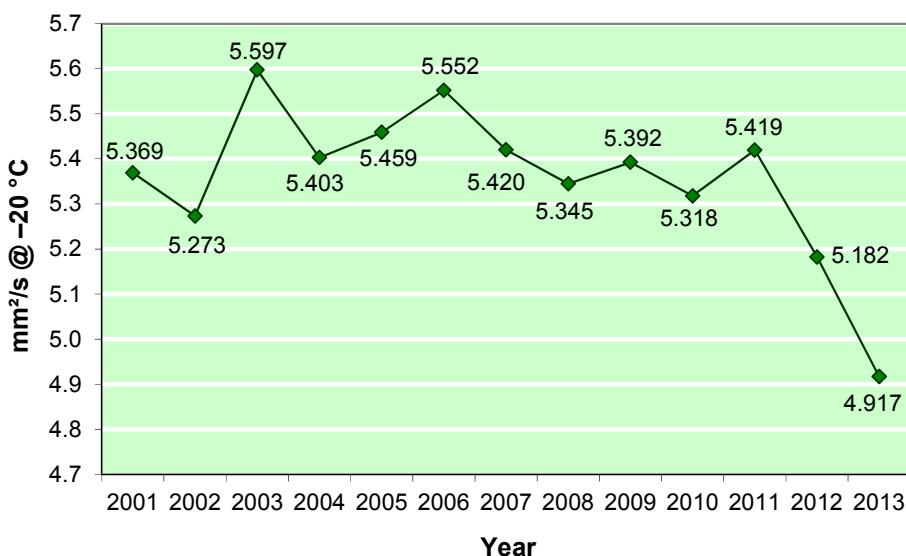


Figure 5-25: Viscosity (mm<sup>2</sup>/s @ -20 °C), 13-Year Trend, maximum 8.5

### Heat Value, Heat of Combustion—2013

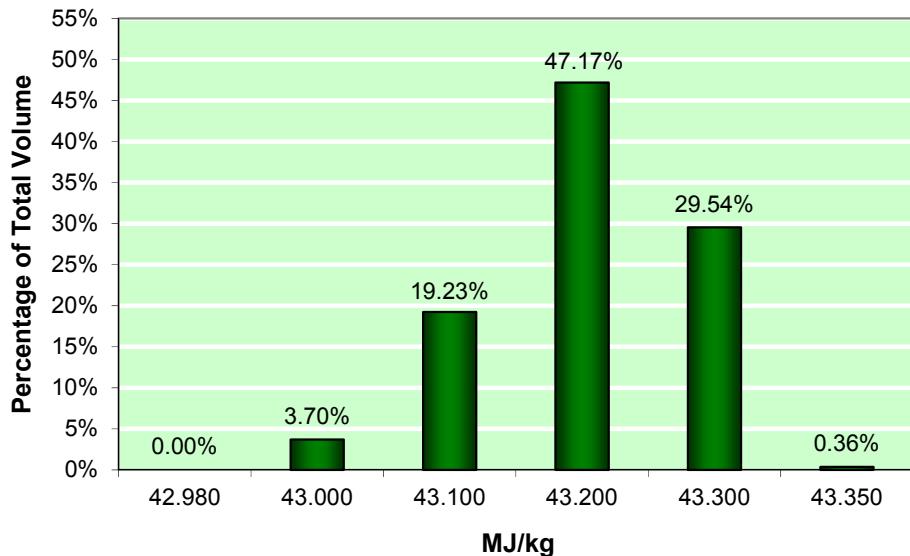


Figure 5-26: Heat Value, Heat of Combustion (MJ/kg), minimum 42.6

### Smoke Point—2013

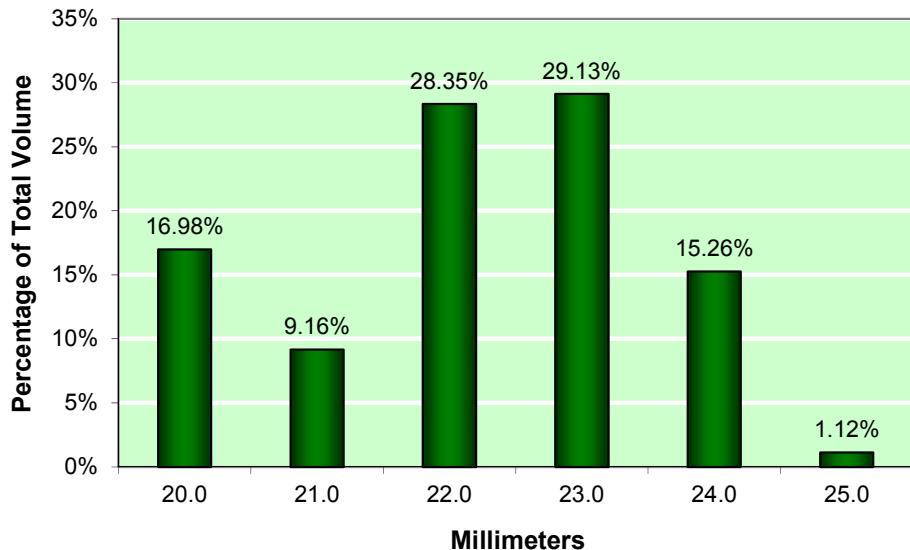


Figure 5-27: Smoke Point (mm), minimum 19.0

## 5. JPS Data

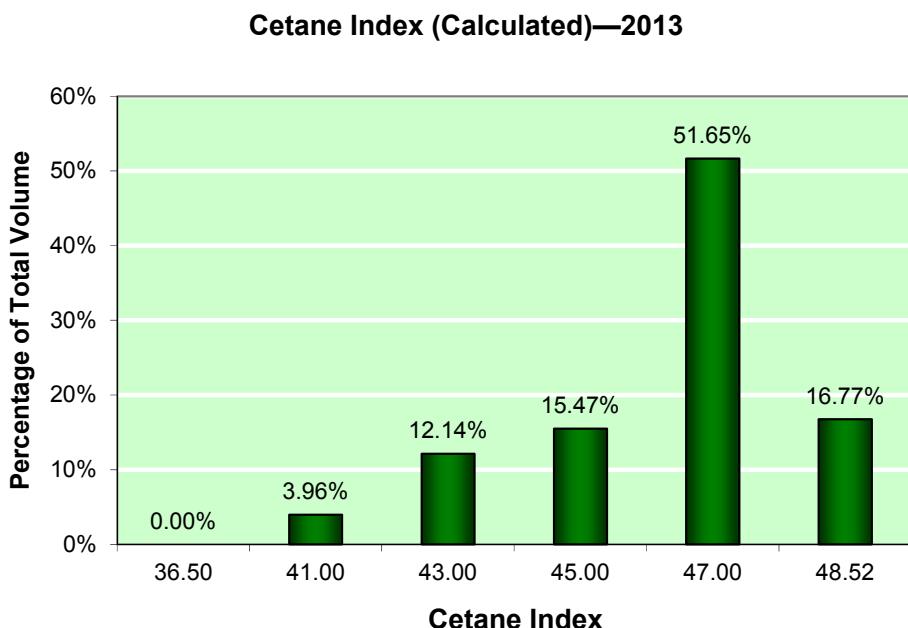


Figure 5-28: Cetane Index (Calculated), Report

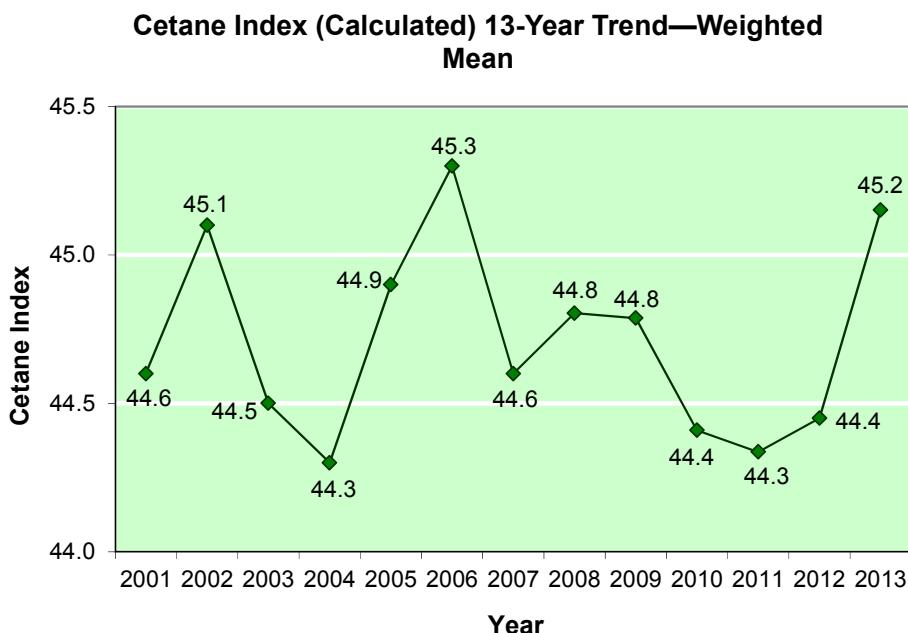


Figure 5-29: Cetane Index (Calculated), 13-Year Trend, Report

## Hydrogen Content—2013

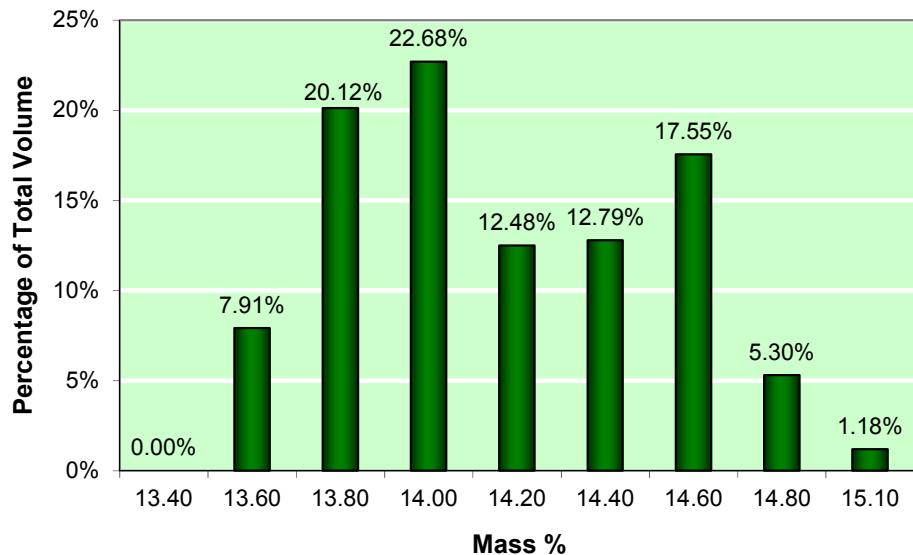


Figure 5-30: Hydrogen Content (mass %), minimum 13.4

## Hydrogen Content 13-Year Trend—Weighted Mean

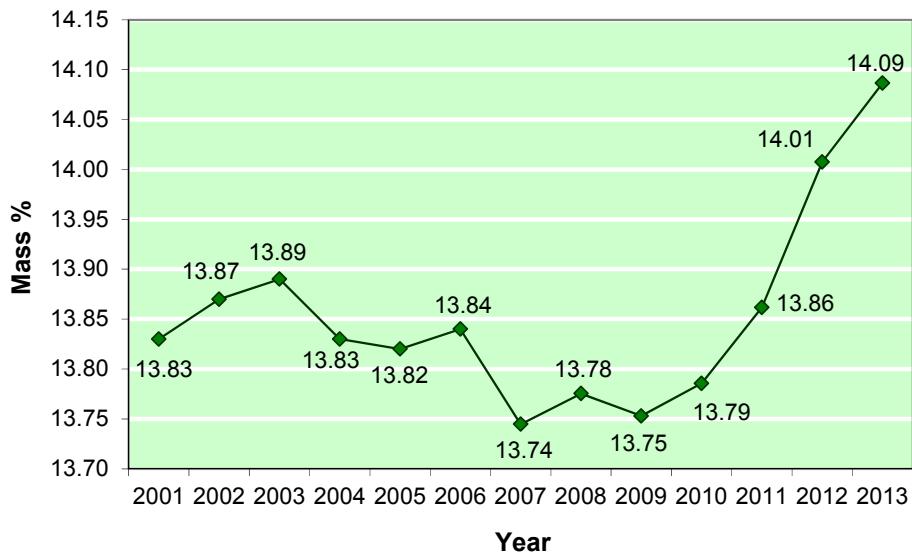


Figure 5-31: Hydrogen Content (mass %), 13-Year Trend, minimum 13.4

## 5. JPS Data

### Thermal Stability (JFTOT @ 275 °C)—2013

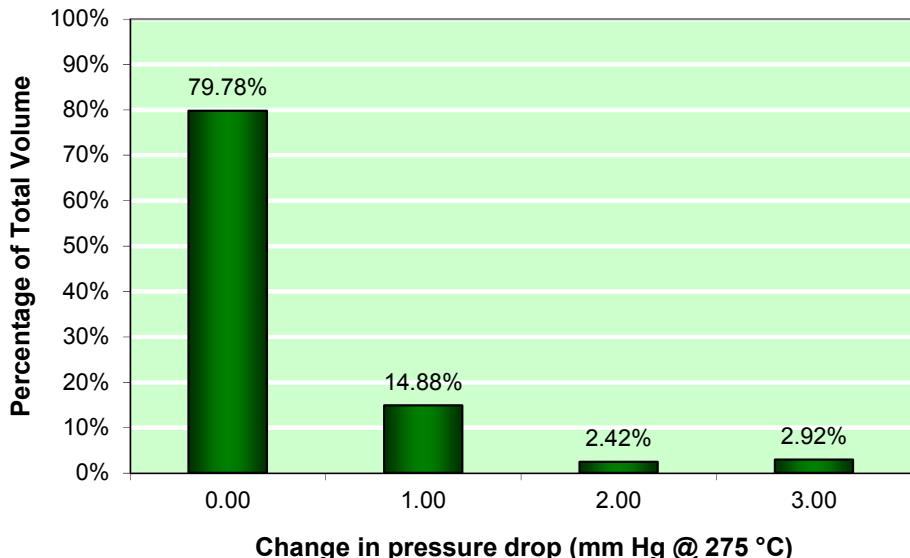


Figure 5-32: Thermal Stability, Change in Pressure Drop (mm Hg @ 275 °C), maximum 25

### Existent Gum—2013

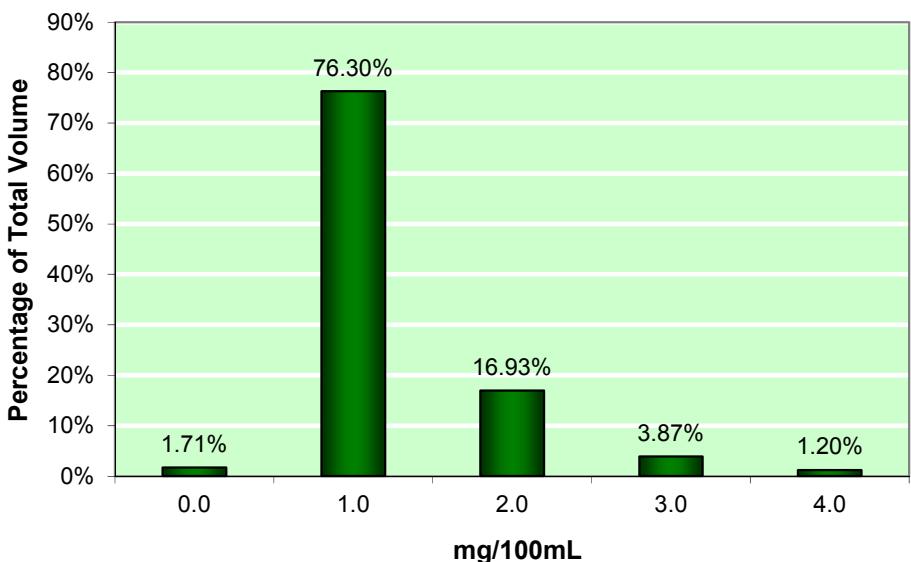


Figure 5-33: Existent Gum (mg/100 mL), maximum 7.0

### Particulate Matter—2013

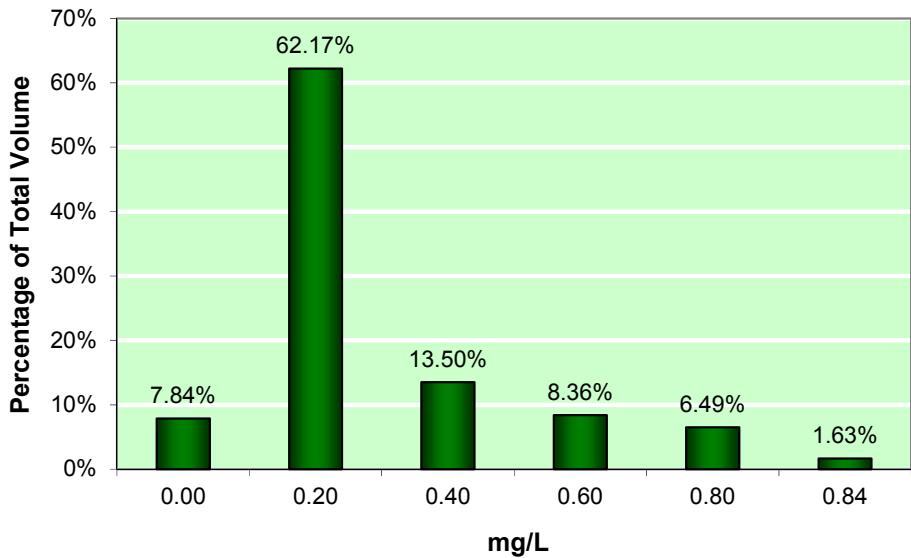


Figure 5-34: Particulate Matter (mg/L), maximum 1.0

### Filtration Time—2013

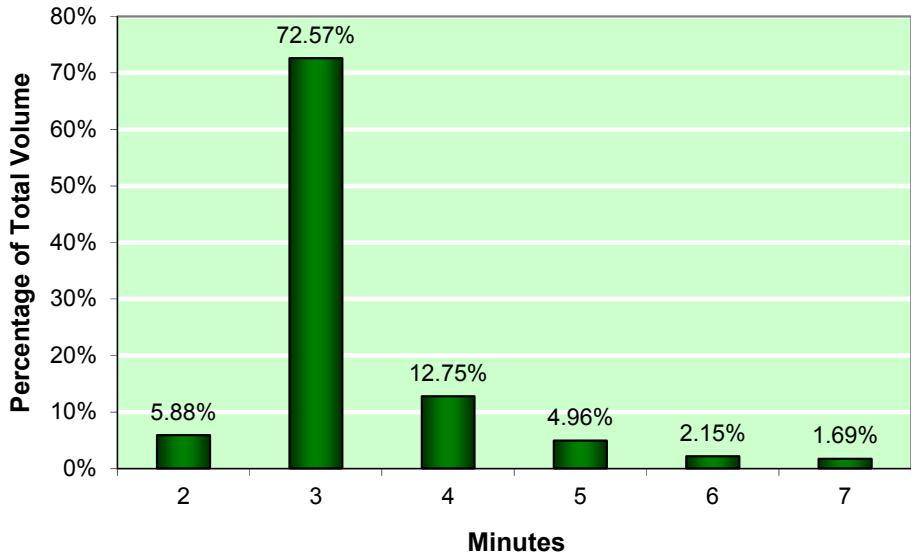


Figure 5-35: Filtration Time (minutes), maximum 15

## 5. JPS Data

Micro Separometer (MSEP)—2013

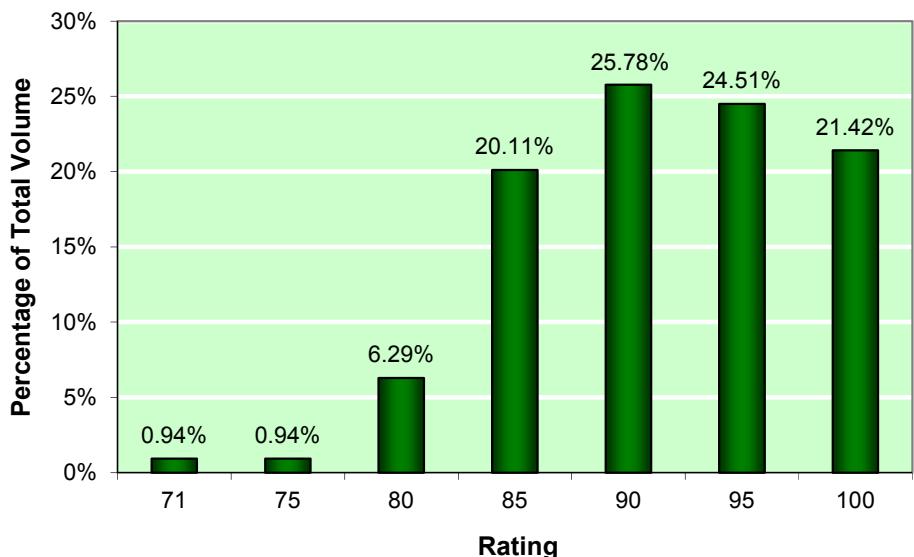


Figure 5-36: Micro Separometer (rating), minimum 70

Fuel System Icing Inhibitor—2013

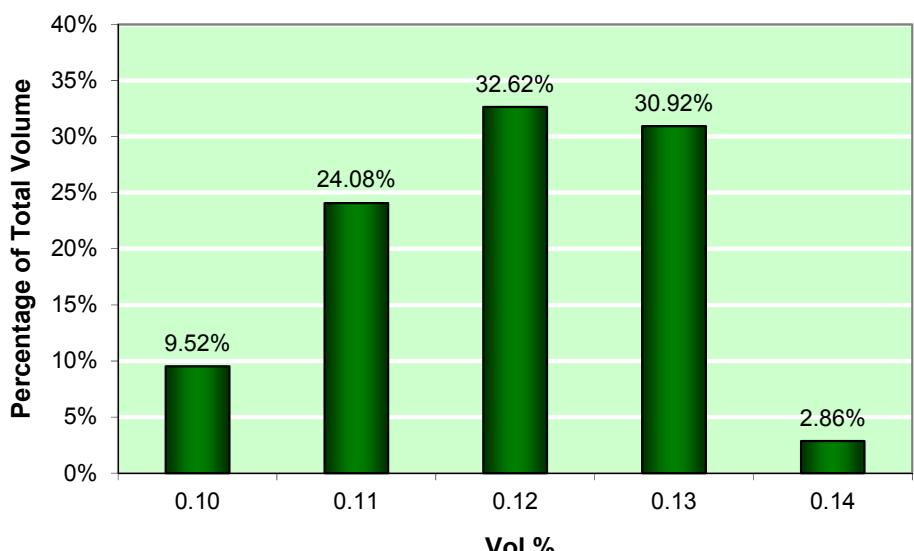


Figure 5-37: Fuel System Icing Inhibitor (vol %), minimum 0.10, maximum 0.15

## 6. JAI Data



## 6. JA1–2013 Data Summary

Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91			
Property	2013 Source Inputs		
	Region	Volume	Analysis
<b>Total Acid Number:</b> (mg KOH/g)	All	284.96	106
<b>Aromatics:</b> (vol %)	All	284.96	106
<b>Sulfur Mercaptan:</b> (mass %)	All	284.96	105
<b>Sulfur, Total:</b> (mass %)	All	281.81	105
<b>Distillation:</b>			
Initial Boiling Point (IBP), (°C)	All	287.76	107
10% Recovered, (°C)	All	287.76	107
50% Recovered, (°C)	All	287.76	107
90% Recovered, (°C)	All	287.76	107
Final Boiling Point (FBP), (°C)	All	287.76	107
Residue, (vol %)	All	282.94	106
Loss, (vol %)	All	282.94	106
<b>Flash Point:</b> (°C)	All	193.76	62
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	All	287.76	107
<b>Freezing Point:</b> (°C)	All	284.96	106
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)	All	284.96	106
<b>Net Heat of Combustion:</b> (MJ/kg)	All	284.96	105
<b>Smoke Point:</b> (mm)	All	284.96	105
<b>Naphthalene:</b> (vol %)	All	140.04	74
<b>Thermal Stability:</b>			
Change in pressure drop, mm Hg @ 275 °C	All	NR	NR
Change in pressure drop, mm Hg @ 260 °C	All	243.41	91
<b>Existent Gum:</b> (mg/100 mL)	All	287.76	106
<b>Particulate Contamination:</b> (mg/L)	All	281.69	104
<b>Water Separation Index:</b> (rating)	All	275.15	106

Table 6-1: Data Summary, Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91, 2013 Source Inputs

## 6. JAI-2013 Data Summary

Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0010	0.0090	0.0027	0.0030
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.00	24.40	17.94	17.64
<b>Sulfur Mercaptan:</b> <sup>1</sup> (mass %)		<b>0.0030</b>	0.0001	0.0028	0.0014	0.0013
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0005	0.3000	0.125	0.138
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)		<b>Report</b>	142.0	163.0	150.0	148.9
10% Recovered, (°C)		<b>205.0</b>	157.9	176.1	168.5	167.2
50% Recovered, (°C)		<b>Report</b>	176.2	206.0	195.5	195.4
90% Recovered, (°C)		<b>Report</b>	196.1	249.3	235.9	238.8
Final Boiling Point (FBP), (°C)		<b>300.0</b>	213.6	284.4	260.0	264.6
Residue, (vol %)		<b>1.5</b>	0.3	1.5	1.2	1.1
Loss, (vol %)		<b>1.5</b>	0.0	1.2	0.5	0.7
<b>Flash Point:</b> (°C)	<b>38.0</b>		38.0	46.0	42.0	41.0
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	<b>775.0</b>	<b>840.0</b>	784.7	809.4	797.8	796.3
<b>Freezing Point:</b> (°C)		<b>-47.0</b>	-72.00	-48.00	-51.98	-51.07
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.000</b>	2.758	4.318	3.698	3.716
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.80</b>		43.092	43.500	43.253	43.280
<b>Smoke Point:</b> <sup>2</sup> (mm)	<b>25.0</b>		19.00	27.00	23.32	24.21
<b>Naphthalene:</b> (vol %)		<b>3.00</b>	0.17	2.70	1.22	1.32
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C		<b>25</b>	NR	NR	NR	NR
Change in pressure drop, mm Hg @ 260 °C			0.00	3.00	1.72	1.26
<b>Existent Gum:</b> (mg/100 mL)		<b>7</b>	0.08	4.00	1.30	1.25
<b>Particulate Contamination:</b> (mg/L)		<b>1.0</b>	0.01	0.90	0.30	0.38
<b>Water Separation Index:</b> <sup>3</sup> (rating)	<b>70</b>		78	100	95.4	96.0

Table 6-2: Data Summary, Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91, 2013 Test Results

**Note 1:** Either the sulfur mercaptan limit or a negative doctor test result is acceptable to meet the specification requirement.

**Note 2:** When the smoke point result is below 25 mm, the product is acceptable so long as the naphthalene content is below 3.0 percent and the smoke point is above the minimum of 19 mm.

**Note 3:** The minimum Water Separation Index rating with SDA is 70. The minimum Water Separation Index rating without SDA is 85.

## 6. JA1–2013 Regional Data Summary

Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91						
Property	Total Volume		100.13			
	Batch Analysis		15			
	Specification Limits		Region 6			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0018	0.0060	0.0029	0.0028
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.16	18.70	17.28	17.13
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.0030</b>				
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0062	0.1670	0.119	0.111
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)		<b>Report</b>	142.0	149.0	146.0	146.0
10% Recovered, (°C)		<b>205.0</b>	160.0	165.3	163.7	163.7
50% Recovered, (°C)		<b>Report</b>	186.0	199.0	194.1	193.5
90% Recovered, (°C)		<b>Report</b>	228.0	247.7	241.8	240.5
Final Boiling Point (FBP), (°C)		<b>300.0</b>	258.0	279.0	270.4	269.3
Residue, (vol %)		<b>1.5</b>	1.0	1.4	1.0	1.0
Loss, (vol %)		<b>1.5</b>	0.4	1.2	1.0	0.9
<b>Flash Point:</b> (°C)	<b>38.0</b>		38.0	42.0	39.8	39.8
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	<b>775.0</b>	<b>840.0</b>	784.7	797.6	793.0	792.5
<b>Freezing Point:</b> (°C)		<b>-47.0</b>	-54.50	-48.50	-50.46	-50.75
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.000</b>	3.342	3.941	3.667	3.648
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.80</b>		43.270	43.437	43.335	43.340
<b>Smoke Point:</b> (mm)	<b>25.0</b>		25.00	27.00	25.80	25.88
<b>Naphthalene:</b> (vol %)		<b>3.00</b>	NR	NR	NR	NR
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C			NR	NR	NR	NR
Change in pressure drop, mm Hg @ 260 °C		<b>25</b>	0.00	0.30	0.06	0.04
<b>Existent Gum:</b> (mg/100 mL)		<b>7</b>	0.08	3.00	1.27	1.17
<b>Particulate Contamination:</b> (mg/L)		<b>1.0</b>	0.20	0.90	0.49	0.48
<b>Water Separation Index:</b> (rating)	<b>70</b>		90	99	96.4	96.2

Table 6-3: Region 6 Summary

## 6. JA1–2013 Regional Data Summary

Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91						
Property	Total Volume		167.47			
	Batch Analysis		89			
	Specification Limits		Region 7			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0010	0.0090	0.0027	0.0031
<b>Aromatics:</b> (vol %)		<b>25.0</b>	15.00	24.40	18.09	18.03
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.0030</b>				
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.0005	0.3000	0.125	0.152
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)		<b>Report</b>	144.1	163.0	150.8	150.7
10% Recovered, (°C)		<b>205.0</b>	157.9	176.1	169.4	169.4
50% Recovered, (°C)		<b>Report</b>	176.2	206.0	195.8	196.9
90% Recovered, (°C)		<b>Report</b>	196.1	249.3	234.8	238.0
Final Boiling Point (FBP), (°C)		<b>300.0</b>	213.6	284.4	258.0	261.8
Residue, (vol %)		<b>1.5</b>	0.8	1.5	1.2	1.2
Loss, (vol %)		<b>1.5</b>	0.0	1.0	0.5	0.5
<b>Flash Point:</b> (°C)	<b>38.0</b>		39.0	46.0	42.73	42.5
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	<b>775.0</b>	<b>840.0</b>	788.9	809.4	798.8	799.2
<b>Freezing Point:</b> (°C)		<b>-47.0</b>	-72.00	-48.00	-52.32	-51.42
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.000</b>	2.758	4.318	3.704	3.765
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.80</b>		43.092	43.500	43.236	43.234
<b>Smoke Point:</b> (mm)	<b>25.0</b>		19.00	26.00	22.89	23.22
<b>Naphthalene:</b> (vol %)		<b>3.00</b>	0.17	2.70	1.24	1.45
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C		<b>25</b>	NR	NR	NR	NR
Change in pressure drop, mm Hg @ 260 °C			0.00	3.00	2.11	2.34
<b>Existent Gum:</b> (mg/100 mL)		<b>7</b>	1.00	4.00	1.33	1.38
<b>Particulate Contamination:</b> (mg/L)		<b>1.0</b>	0.01	0.81	0.26	0.29
<b>Water Separation Index:</b> (rating)	<b>70</b>		78	100	95.2	95.7

Table 6-4: Region 7 Summary

## 6. JA1–2013 Regional Data Summary

Jet A-1 Turbine Fuel, Aviation, Defence Standard 91-91						
Property	Total Volume		20.17			
	Batch Analysis		3			
	Specification Limits		Region 8			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Total Acid Number:</b> (mg KOH/g)		<b>0.015</b>	0.0020	0.0050	0.0030	0.0035
<b>Aromatics:</b> (vol %)		<b>25.0</b>	16.90	17.00	16.93	16.95
<b>Sulfur Mercaptan:</b> (mass %)		<b>0.0030</b>				
<b>Sulfur, Total:</b> (mass %)		<b>0.30</b>	0.1400	0.1900	0.160	0.165
<b>Distillation:</b>						
Initial Boiling Point (IBP), (°C)		<b>Report</b>	147.0	148.0	147.3	147.5
10% Recovered, (°C)		<b>205.0</b>	166.0	167.0	166.3	166.0
50% Recovered, (°C)		<b>Report</b>	193.0	193.0	193.0	193.0
90% Recovered, (°C)		<b>Report</b>	236.0	238.0	237.0	237.0
Final Boiling Point (FBP), (°C)		<b>300.0</b>	265.0	266.0	265.3	265.0
Residue, (vol %)		<b>1.5</b>	0.3	0.5	0.4	0.4
Loss, (vol %)		<b>1.5</b>	0.5	1.0	0.7	0.9
<b>Flash Point:</b> (°C)	<b>38.0</b>		42.0	42.0	42.0	42.0
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	<b>775.0</b>	<b>840.0</b>	790.1	792.8	791.2	790.4
<b>Freezing Point:</b> (°C)		<b>-47.0</b>	-50.50	-49.00	-49.83	-49.75
<b>Viscosity:</b> (mm <sup>2</sup> /s @ -20 °C)		<b>8.000</b>	3.656	3.680	3.664	3.656
<b>Net Heat of Combustion:</b> (MJ/kg)	<b>42.80</b>		43.300	43.400	43.333	43.350
<b>Smoke Point:</b> (mm)	<b>25.0</b>		24.00	24.00	24.00	24.00
<b>Naphthalene:</b> (vol %)		<b>3.00</b>	0.60	0.70	0.63	0.60
<b>Thermal Stability:</b>						
Change in pressure drop, mm Hg @ 275 °C			NR	NR	NR	NR
Change in pressure drop, mm Hg @ 260 °C		<b>25</b>	0.00	0.00	0.00	0.00
<b>Existent Gum:</b> (mg/100 mL)		<b>7</b>	0.51	0.70	0.60	0.55
<b>Particulate Contamination:</b> (mg/L)		<b>1.0</b>	0.38	0.61	0.53	0.61
<b>Water Separation Index:</b> (rating)	<b>70</b>		98	98	98.0	98.0

Table 6-5: Region 8 Summary

## 6. JA1—Assessment Summary

### ***Overview:***

JA1 was first featured in the 2004 report because of increasing annual procurements. In 2013, 107 reported analyses, representing 287.76 million U.S. gallons of JA1, were processed in the PQIS database by Regions 6, 7, and 8. This was a decrease from the 177 reported JA1 analyses and the 447.07 million U.S. gallons of JA1 queried from the PQIS in 2012.

### ***Trending:***

**Total Acid Number.** The weighted mean decreased 0.0018 mg KOH/g from 2011 to 2013.

**Sulfur, Total.** The weighted mean increased 0.039 mass % from 2012 to 2013.

**Distillation Final Boiling Point.** The weighted mean increased 5.4 °C from 2012 to 2013.

**Existent Gum.** The weighted mean decreased 0.60 mg/100 mL from 2011 to 2013.

### ***JA1 Observations:***

All batches met specification requirements for 2013.

The minimum rating for **Water Separation Index** with SDA is 70. The minimum Water Separation Index rating without SDA is 85.



## 6. JAI Data

### Total Acid Number—2013

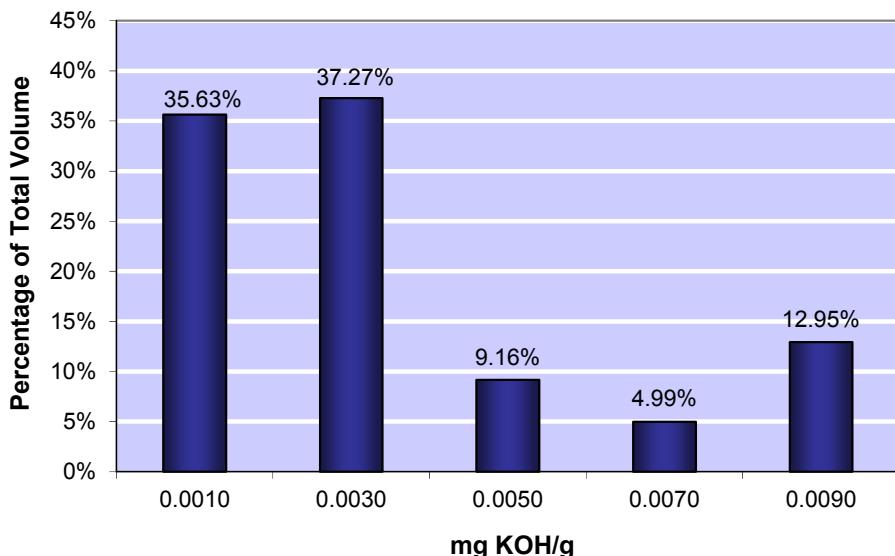


Figure 6-1: Total Acid Number (mg KOH/g), maximum 0.015

### Total Acid Number 10-Year Trend—Weighted Mean

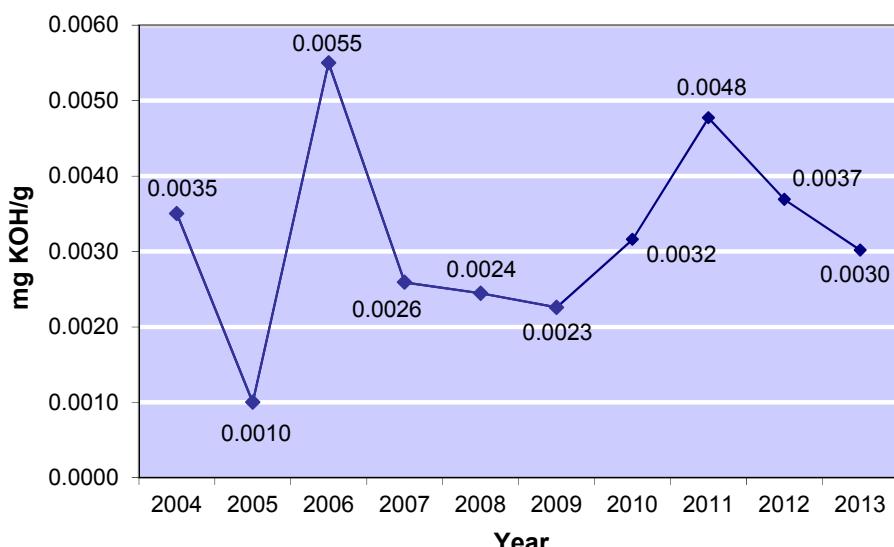


Figure 6-2: Total Acid Number (mg KOH/g), 10-Year Trend, maximum 0.015

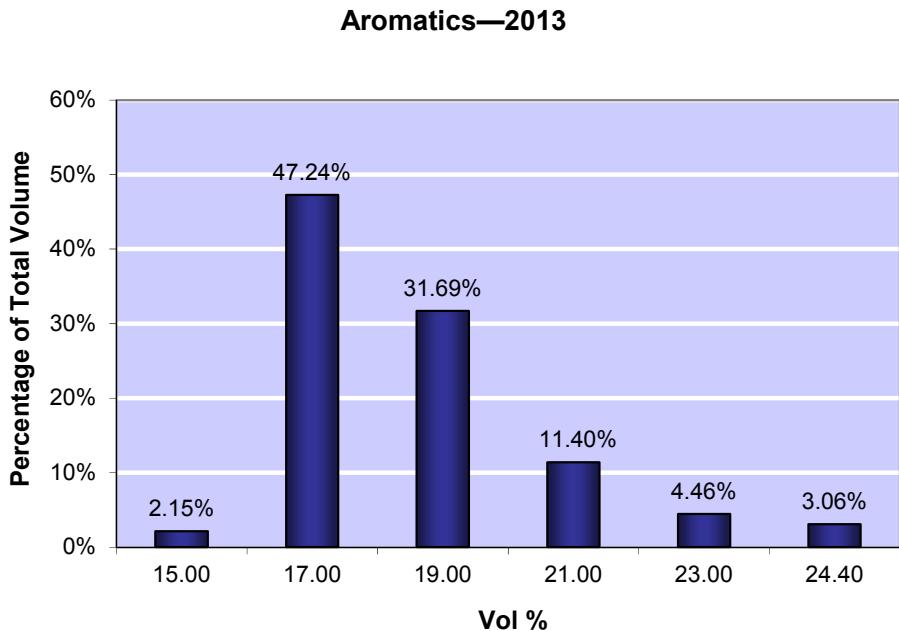


Figure 6-3: Aromatics (vol %), maximum 25.0

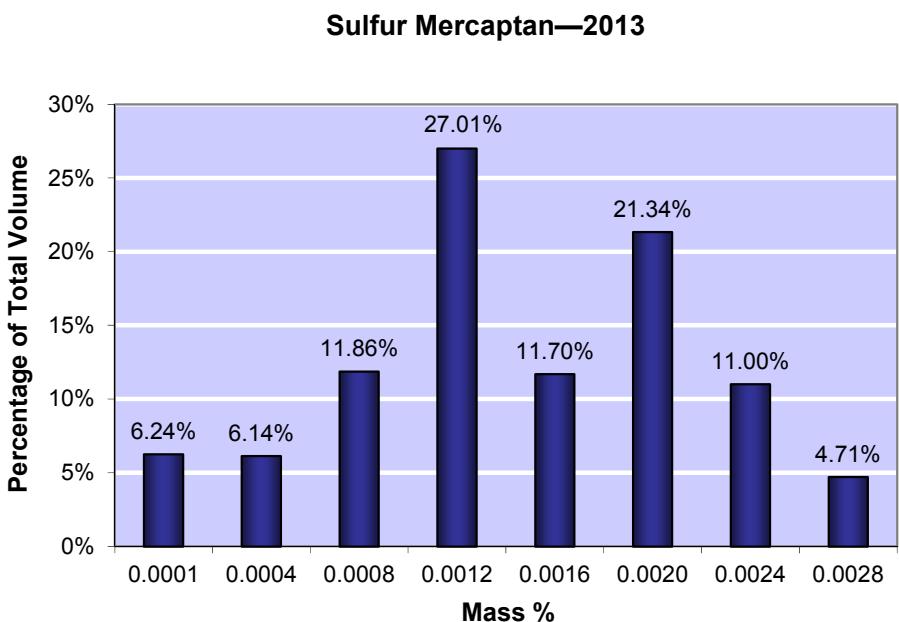


Figure 6-4: Sulfur Mercaptan (mass %), maximum 0.0030

## 6. JAI Data

### Sulfur, Total—2013

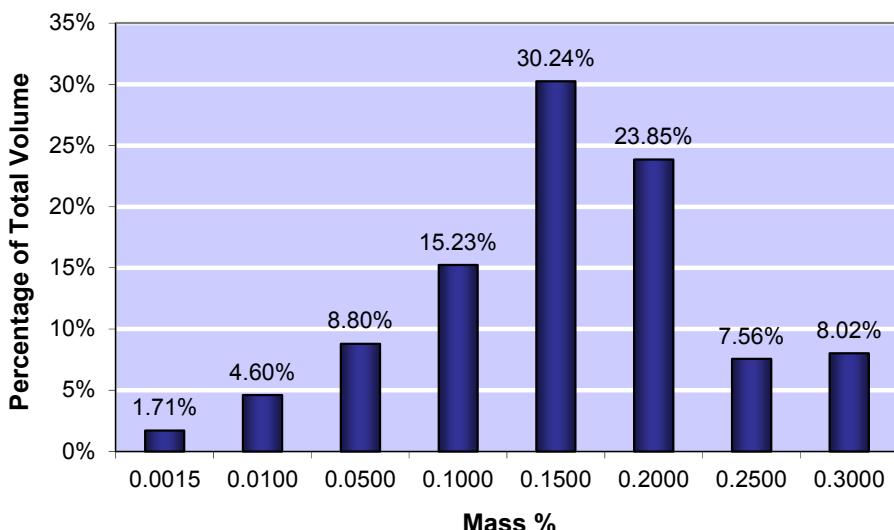


Figure 6-5: Sulfur, Total (mass %), maximum 0.30

### Sulfur, Total 10-Year Trend—Weighted Mean

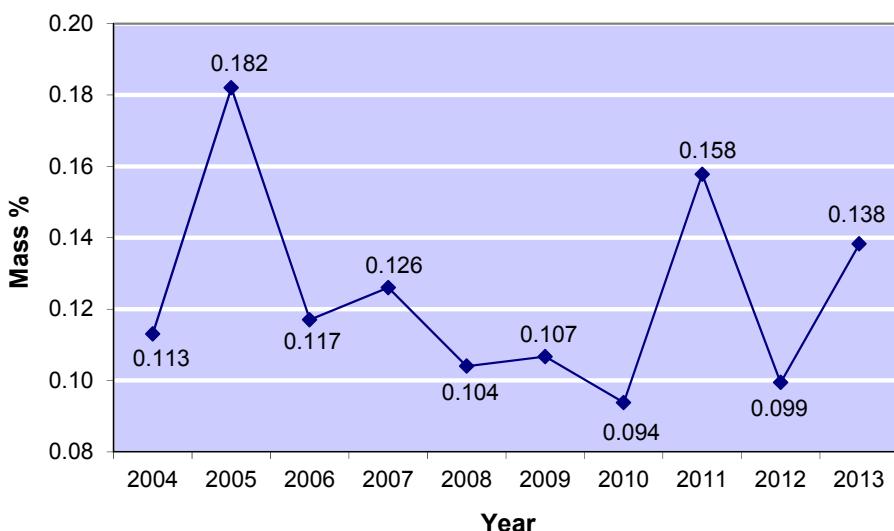


Figure 6-6: Sulfur, Total (mass %), 10-Year Trend, maximum 0.30

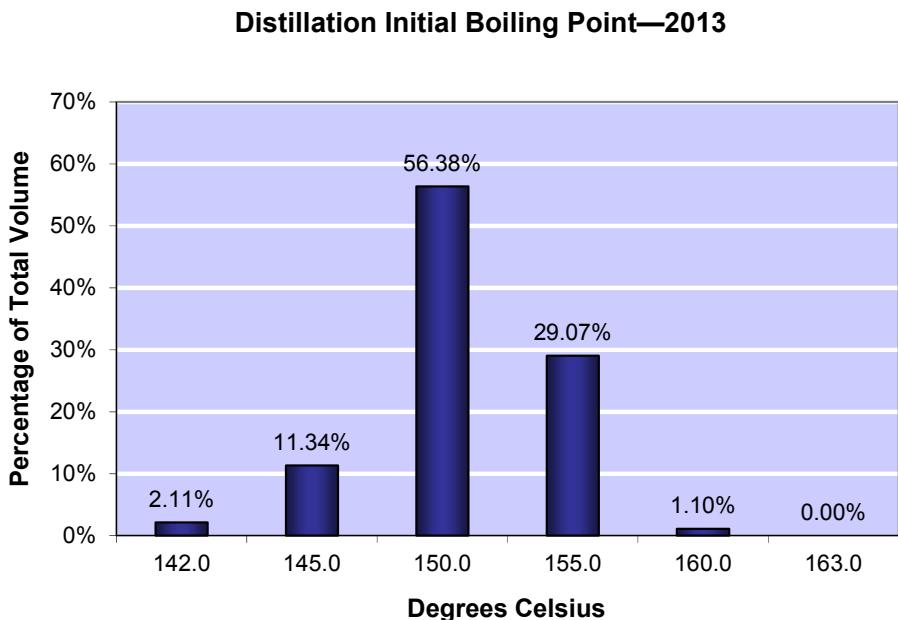


Figure 6-7: Distillation Initial Boiling Point (°C), Report

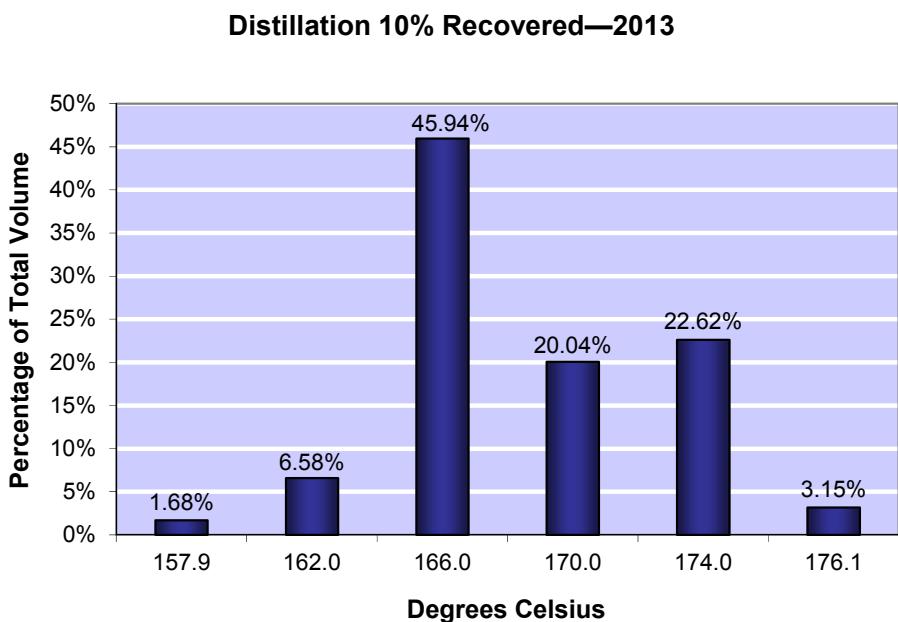


Figure 6-8: Distillation 10% Recovered (°C), maximum 205.0

## 6. JA1 Data

Distillation 50% Recovered—2013

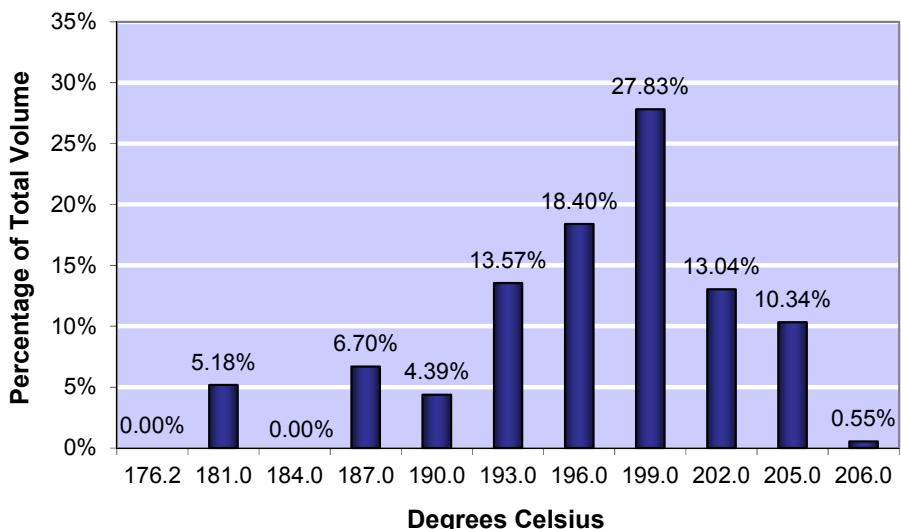


Figure 6-9: Distillation 50% Recovered (°C), Report

Distillation 90% Recovered—2013

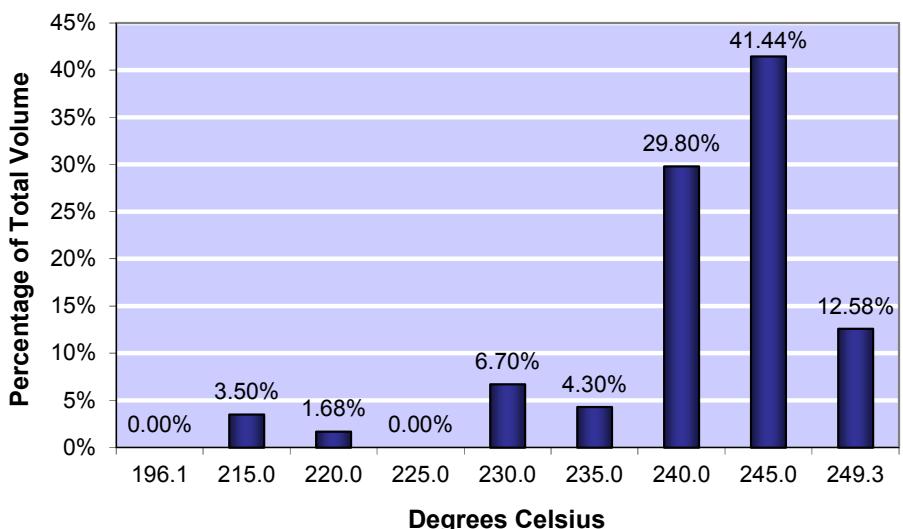


Figure 6-10: Distillation 90% Recovered (°C), Report

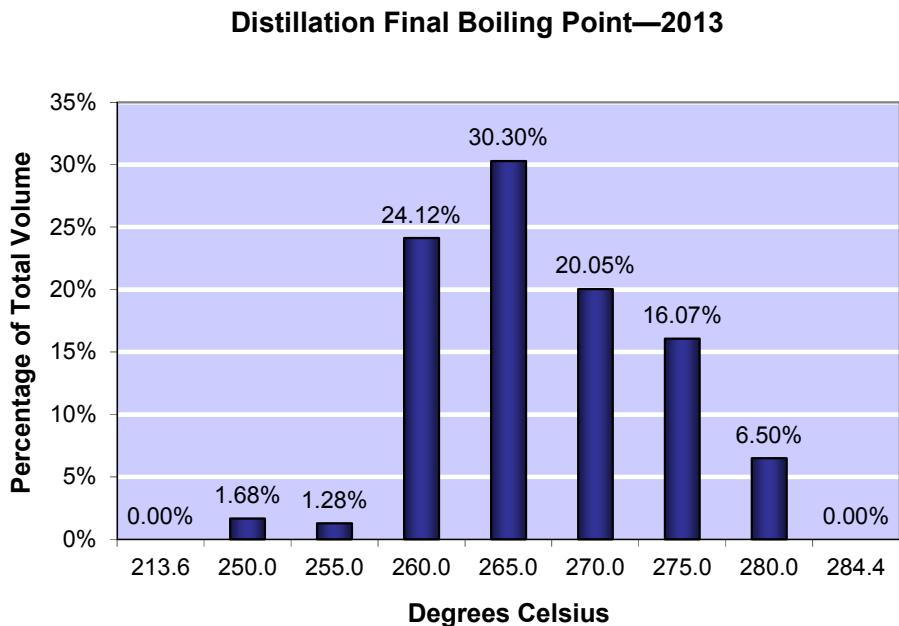


Figure 6-11: Distillation Final Boiling Point (°C), maximum 300.0

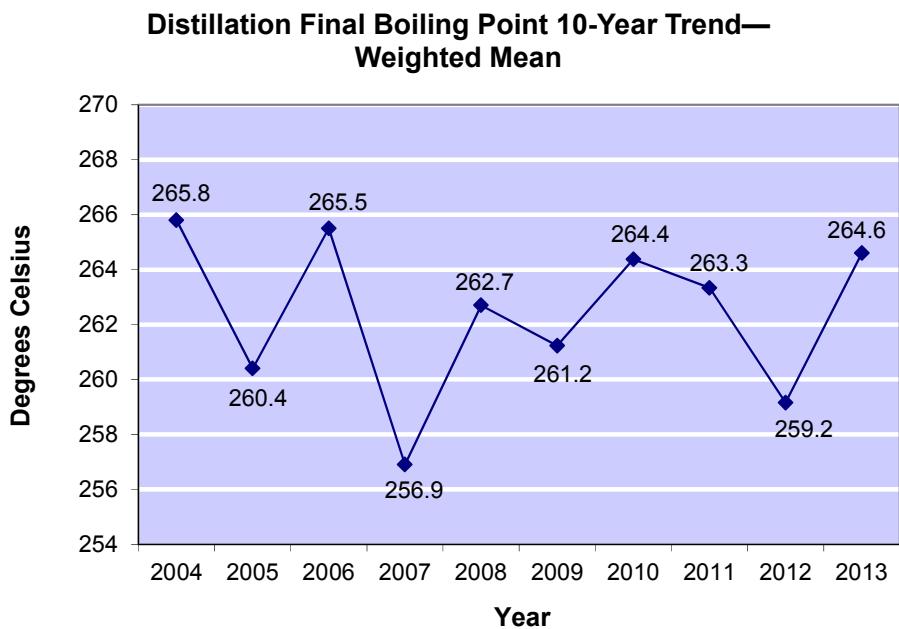


Figure 6-12: Distillation Final Boiling Point (°C), 10-Year Trend, maximum 300.0

## 6. JA1 Data

Distillation Residue—2013

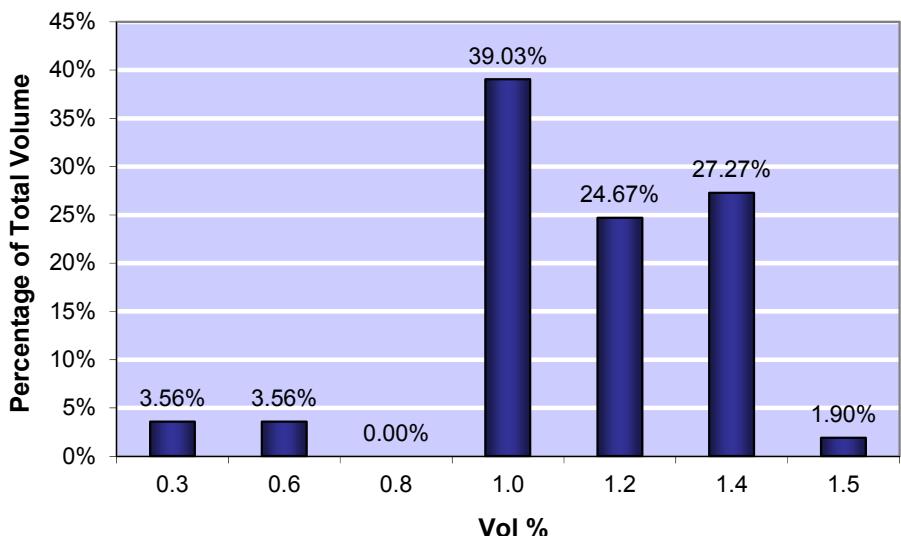


Figure 6-13: Distillation Residue (vol %), maximum 1.5

Distillation Loss—2013

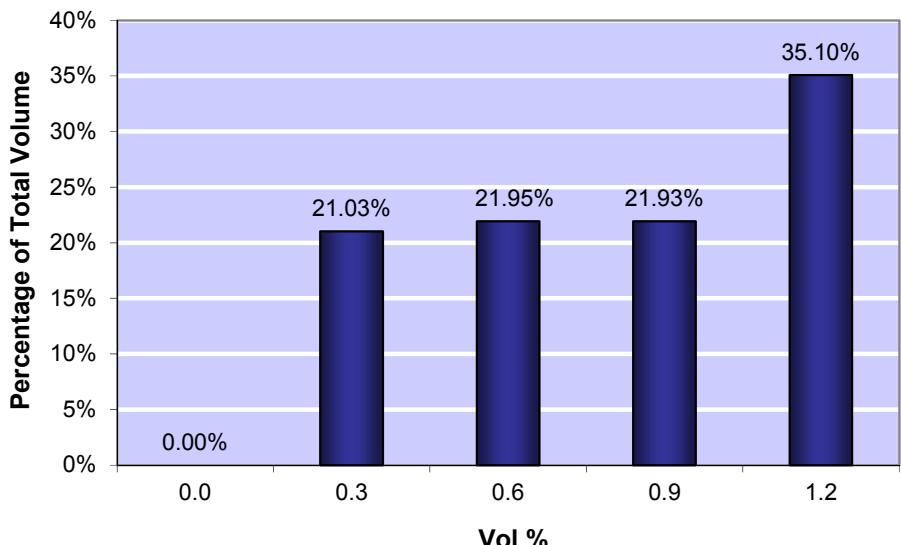


Figure 6-14: Distillation Loss (vol %), maximum 1.5

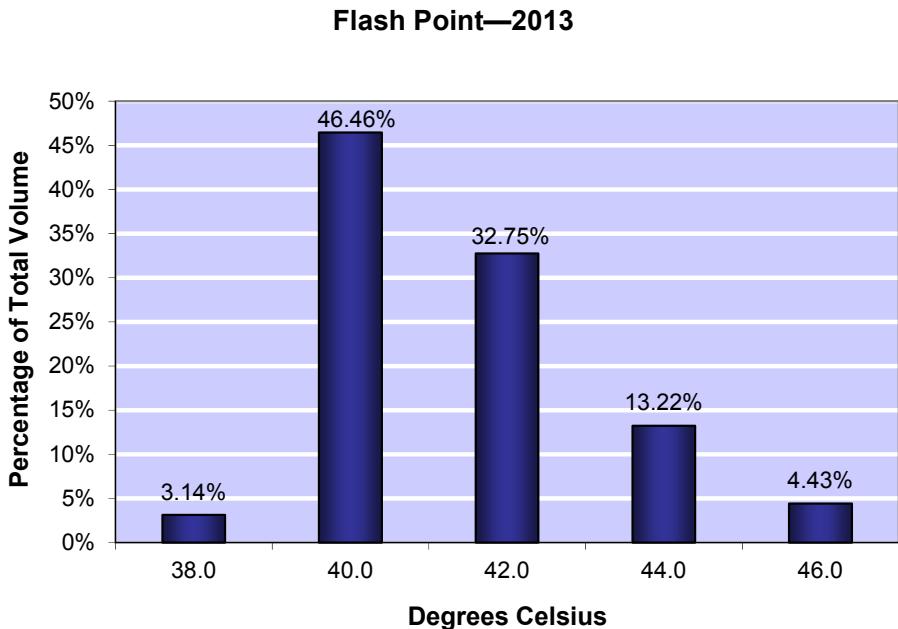


Figure 6-15: Flash Point (°C), minimum 38.0

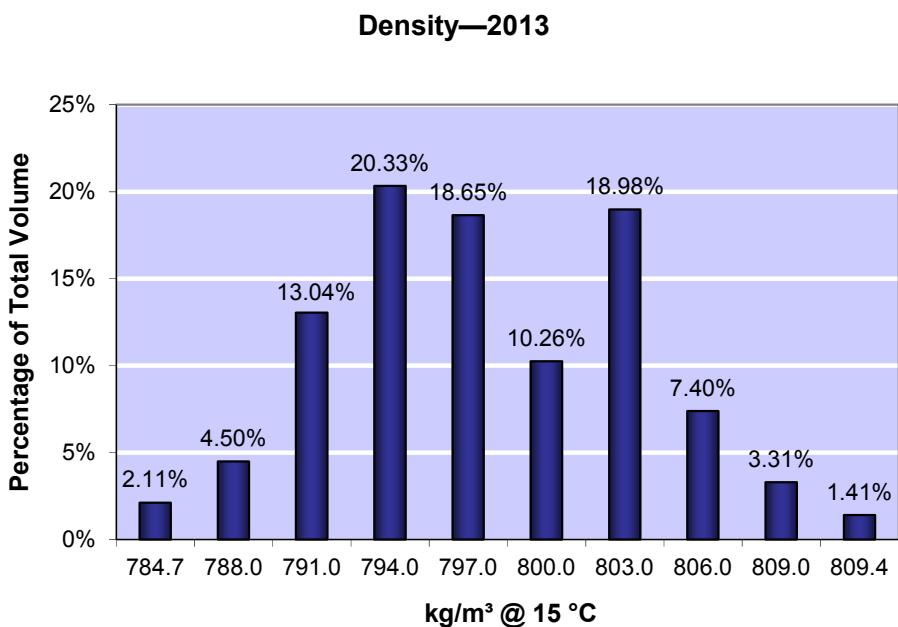


Figure 6-16: Density (kg/m³ @ 15 °C), minimum 775, maximum 840

## 6. JA1 Data

### Freezing Point—2013

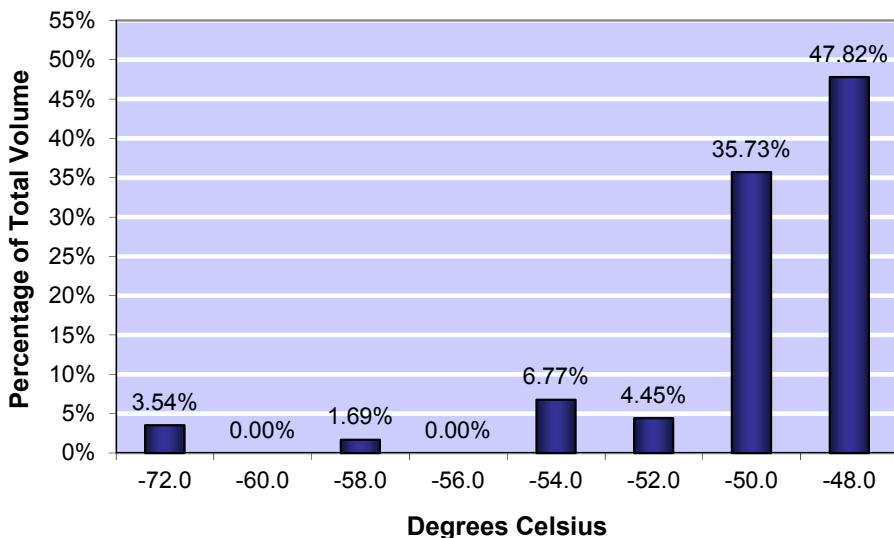


Figure 6-17: Freezing Point (°C), maximum –47.0

### Viscosity—2013

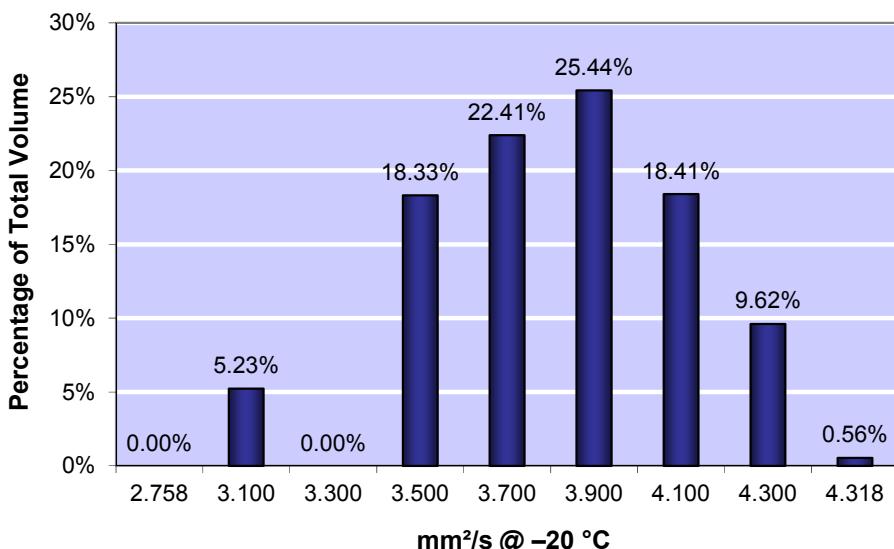


Figure 6-18: Viscosity ( $\text{mm}^2/\text{s} @ -20^\circ\text{C}$ ), maximum 8.000

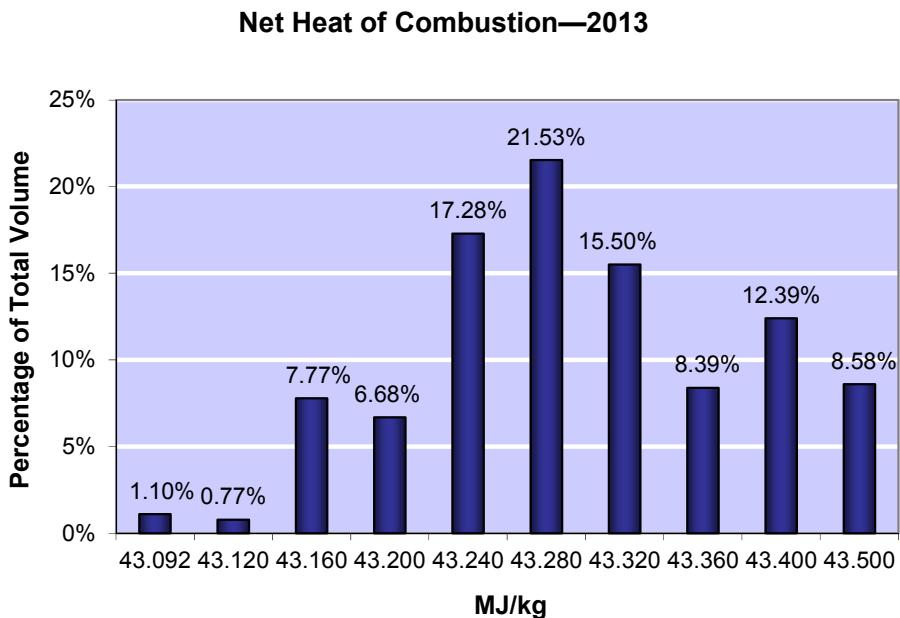


Figure 6-19: Net Heat of Combustion (MJ/kg), minimum 42.80

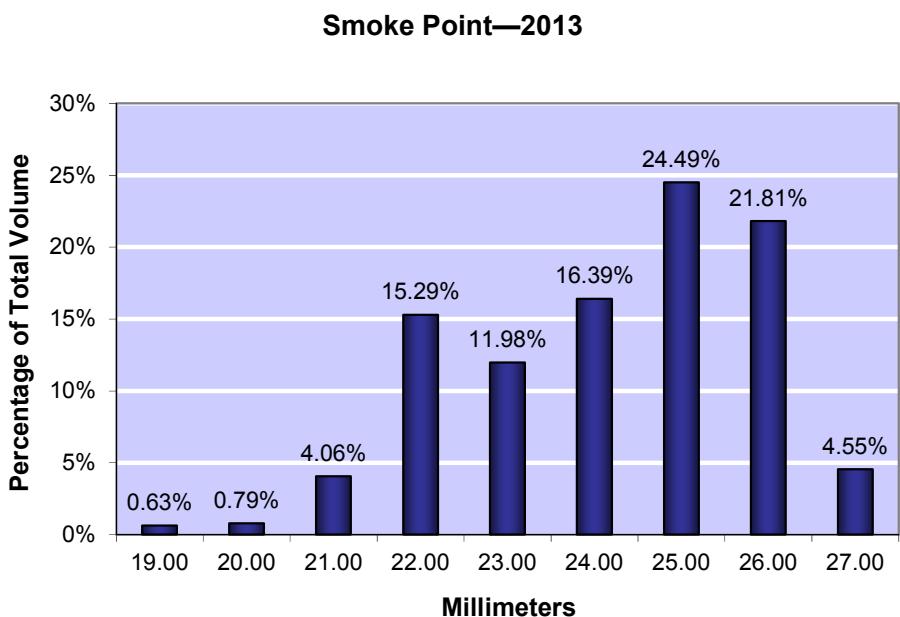


Figure 6-20: Smoke Point (mm), minimum 25.0

## 6. JAI Data

### Naphthalene—2013

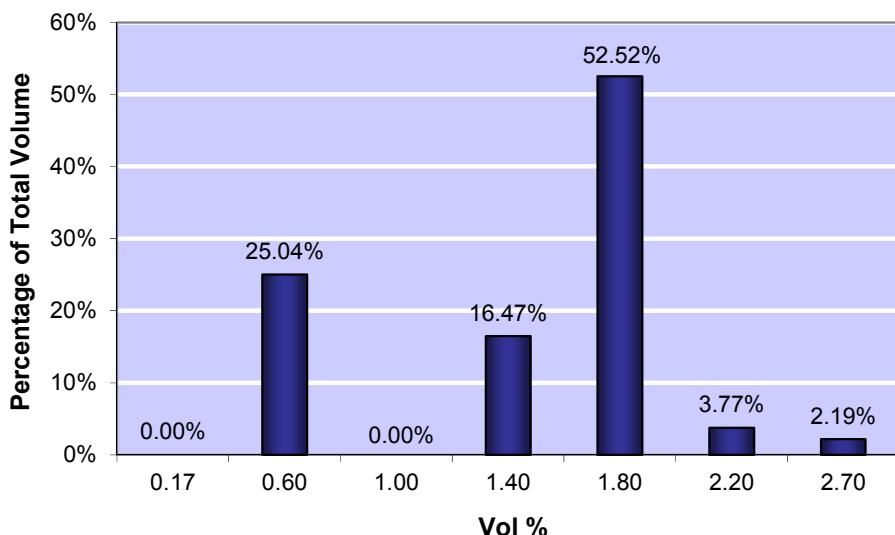


Figure 6-21: Naphthalene (vol %), maximum 3.00

### Thermal Stability (JFTOT @ 260 °C)—2013

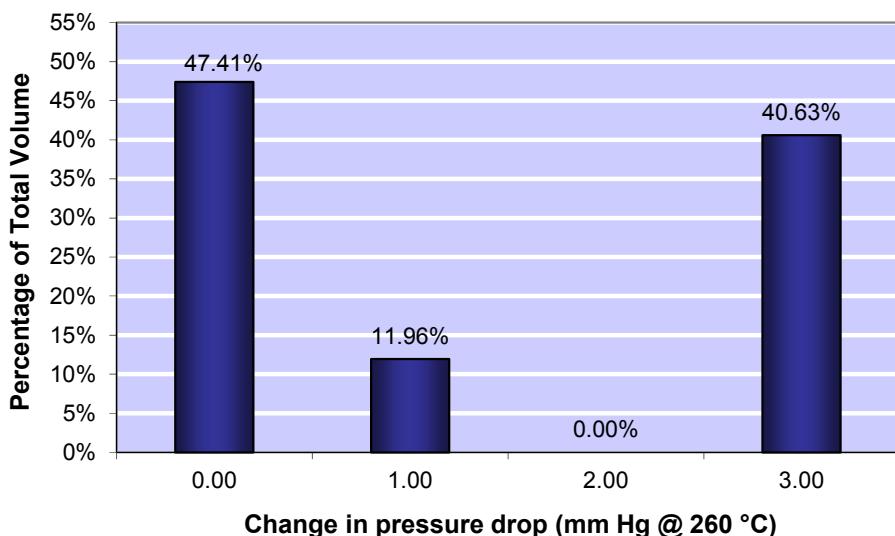


Figure 6-22: Thermal Stability, Change in Pressure Drop (mm Hg @ 260 °C), maximum 25

## Existent Gum—2013

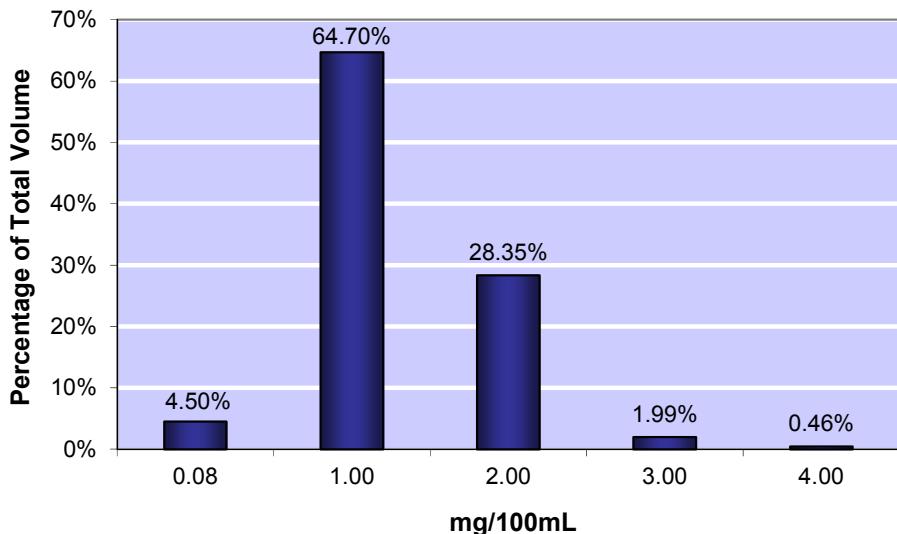


Figure 6-23: Existent Gum (mg/100 mL), maximum 7

## Existent Gum 10-Year Trend—Weighted Mean

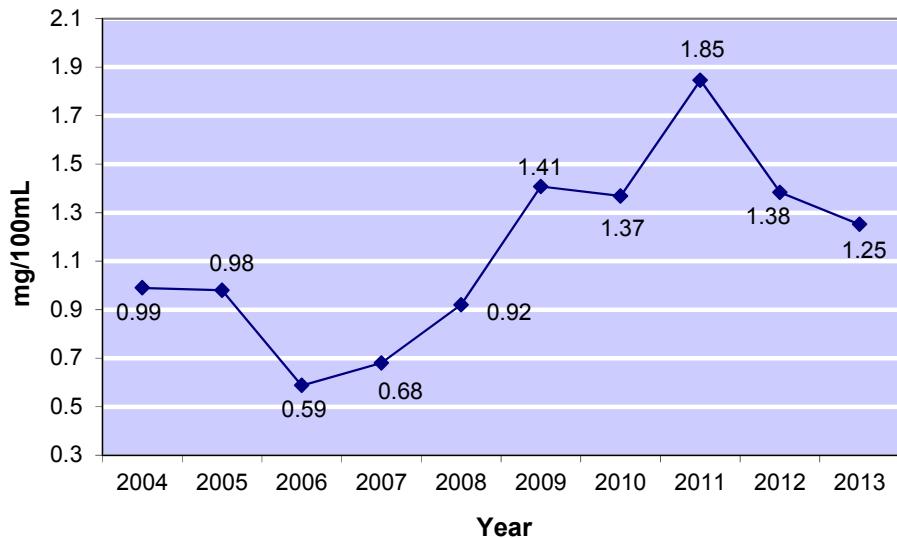


Figure 6-24: Existent Gum (mg/100 mL), 10-Year Trend, maximum 7

## 6. JA1 Data

### Particulate Contamination—2013

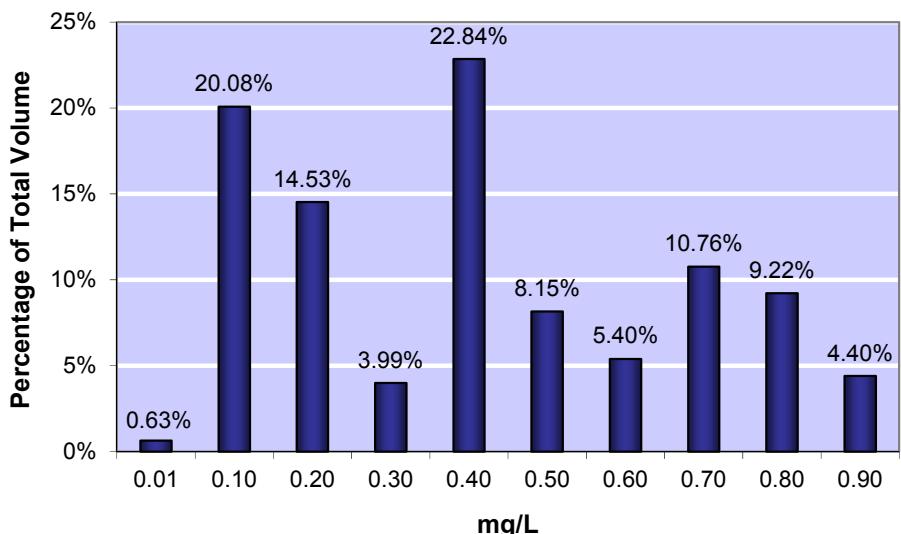


Figure 6-25: Particulate Contamination (mg/L), maximum 1.0

### Water Separation Index—2013

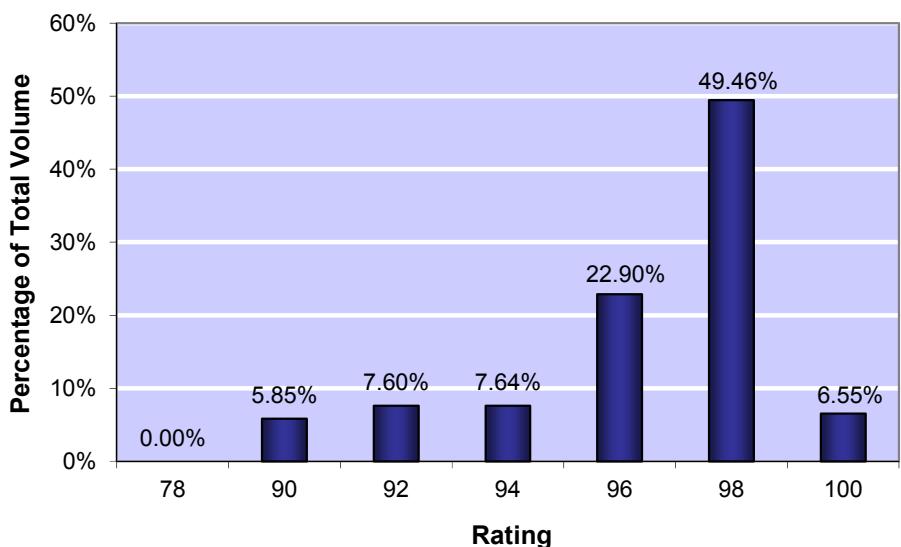


Figure 6-26: Water Separation Index (rating), minimum 70



# 7. F76–2013 Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)			
Property	2013 Source Inputs		
	Region	Volume	Batches
<b>Acid Number:</b> (mg KOH/g)	All	351.32	84
<b>Sulfur Content:</b> (wt. %)	All	351.32	84
<b>Distillation:</b>			
10% Point, (°C)	All	365.61	89
50% Point, (°C)	All	365.61	89
90% Point, (°C)	All	365.61	89
End Point, (°C)	All	365.61	89
Residue + Loss, (vol %)	All	365.61	89
<b>Flash Point:</b> (°C)	All	365.61	89
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	All	360.38	88
<b>Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	All	351.32	83
<b>Cetane Index:</b> (calculated)	All	297.38	64
<b>Hydrogen Content:</b> (wt. %)	All	347.54	83
<b>Ash:</b> (wt. %)	All	351.32	84
<b>Cloud Point:</b> (°C)	All	353.84	85
<b>Pour Point:</b> (°C)	All	353.84	85
<b>Particulate Contamination:</b> (mg/L)	All	365.61	89
<b>Carbon Residue on 10% Bottoms:</b>			
D-524 (wt. %)	All	112.93	35
D-189 & D-4530 (wt. %)	All	238.39	49
<b>Demulsification:</b> (minutes @ 25 °C)	All	327.52	77
<b>Color:</b>	All	365.61	85
<b>Storage Stability:</b>			
D-2274 (mg/100mL)	All	104.35	34
D-5304 (mg/100mL)	All	246.97	50
<b>Calcium:</b> (ppm)	All	351.32	84
<b>Lead:</b> (ppm)	All	351.32	84
<b>Sodium + Potassium:</b> (ppm)	All	351.32	84
<b>Vanadium:</b> (ppm)	All	351.32	84

Table 7-1: Data Summary, MIL-DTL-16884 Fuel, Naval Distillate (NATO F-76), 2013 Source Inputs

## 7. F76–2013 Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Acid Number:</b> (mg KOH/g)		<b>0.30</b>	0.000	0.295	0.087	0.077
<b>Sulfur Content:</b> (wt. %)		<b>0.1</b>	0.0000	0.4420	0.091	0.094
<b>Distillation:</b>						
10% Point, (°C)	<b>Report</b>		193.0	268.5	220.9	219.0
50% Point, (°C)	<b>Report</b>		225.0	294.8	272.0	271.7
90% Point, (°C)		<b>357</b>	281.0	349.0	331.0	332.0
End Point, (°C)		<b>385</b>	319.0	378.0	360.3	362.0
Residue + Loss, (vol %)		<b>3.0</b>	0.7	3.0	1.94	1.94
<b>Flash Point:</b> (°C)	<b>60</b>		60.0	91.0	72.08	71.64
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)		<b>876</b>	797.7	874.8	842.9	838.5
<b>Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	<b>1.7</b>	<b>4.3</b>	1.891	4.020	3.107	3.062
<b>Cetane Index:</b> (calculated)	<b>43</b>		44.10	68.70	53.70	54.26
<b>Hydrogen Content:</b> (wt. %)	<b>12.5</b>		12.60	15.90	13.39	13.48
<b>Ash:</b> (wt. %)		<b>0.005</b>	0.0000	0.0050	0.0013	0.0012
<b>Cloud Point:</b> (°C)		<b>-1</b>	-50.0	-1.0	-10.9	-8.8
<b>Pour Point:</b> (°C)		<b>-6</b>	-69.0	-6.0	-17.7	-15.4
<b>Particulate Contamination:</b> (mg/L)		<b>10</b>	0.10	8.50	2.38	2.50
<b>Carbon Residue on 10% Bottoms:</b>						
D-524 (wt. %)		<b>0.20</b>	0.060	0.190	0.124	0.125
D-189 & D-4530 (wt. %)		<b>0.14</b>	0.001	0.140	0.032	0.027
<b>Demulsification:</b> (minutes @ 25 °C)		<b>10</b>	1.00	5.00	3.52	3.33
<b>Color:</b>		<b>3</b>	0.00	2.00	0.87	0.84
<b>Storage Stability:</b>						
D-2274 (mg/100mL)		<b>1.5</b>	0.00	1.30	0.37	0.36
D-5304 (mg/100mL)		<b>3.0</b>	0.00	2.20	1.08	1.12
<b>Calcium:</b> (ppm)		<b>1.0</b>	0.00	1.00	0.21	0.24
<b>Lead:</b> (ppm)		<b>0.5</b>	0.00	0.50	0.16	0.17
<b>Sodium + Potassium:</b> (ppm)		<b>1.0</b>	0.00	1.00	0.40	0.39
<b>Vanadium:</b> (ppm)		<b>0.5</b>	0.00	0.50	0.14	0.16

Table 7-2: Data Summary, MIL-DTL-16884 Fuel, Naval Distillate (NATO F-76), 2013 Test Results

# 7. F76–2013 Regional Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)						
Property	Total Volume		67.37			
	Batch Analysis		17			
	Specification Limits		Region 3			
	Min	Max	Min	Max	Mean	Wt Mean
Acid Number: (mg KOH/g)		0.30	0.000	0.240	0.159	0.160
Sulfur Content: (wt. %)		0.1	0.0600	0.0916	0.079	0.079
Distillation:						
10% Point, (°C)	Report		197.7	249.0	225.9	226.6
50% Point, (°C)	Report		225.0	289.8	275.8	276.3
90% Point, (°C)		357	316.1	341.5	332.7	332.7
End Point, (°C)		385	346.3	366.1	359.8	359.9
Residue + Loss, (vol %)		3.0	1.8	3.0	2.27	2.30
Flash Point: (°C)	60		61.0	86.0	71.65	71.89
Density: (kg/m <sup>3</sup> @ 15 °C)		876	819.9	849.7	841.1	840.9
Viscosity: (mm <sup>2</sup> /s @ 40 °C)	1.7	4.3	2.196	3.889	3.219	3.229
Cetane Index: (calculated)	43		44.10	53.90	51.80	51.87
Hydrogen Content: (wt. %)	12.5		12.90	14.00	13.55	13.56
Ash: (wt. %)		0.005	0.0000	0.0010	0.0006	0.0006
Cloud Point: (°C)		-1	-13.0	-4.0	-6.9	-6.8
Pour Point: (°C)		-6	-24.0	-6.0	-11.3	-11.2
Particulate Contamination: (mg/L)		10	0.60	4.20	1.93	1.94
Carbon Residue on 10% Bottoms:						
D-524 (wt. %)		0.20	0.080	0.190	0.113	0.115
D-189 & D-4530 (wt. %)		0.14	NR	NR	NR	NR
Demulsification: (minutes @ 25 °C)		10	5.00	5.00	5.00	5.00
Color:		3	0.00	1.50	0.71	0.68
Storage Stability:						
D-2274 (mg/100mL)		1.5	0.00	0.50	0.20	0.21
D-5304 (mg/100mL)		3.0	0.00	1.20	0.24	0.23
Calcium: (ppm)		1.0	0.00	0.10	0.06	0.06
Lead: (ppm)		0.5	0.00	0.10	0.06	0.06
Sodium + Potassium: (ppm)		1.0	0.00	0.20	0.12	0.12
Vanadium: (ppm)		0.5	0.00	0.10	0.06	0.06

Table 7-3: Region 3 Summary

# 7. F76–2013 Regional Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)						
Property	Total Volume		53.31			
	Batch Analysis		20			
	Specification Limits		Region 5			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Acid Number:</b> (mg KOH/g)		<b>0.30</b>	0.000	0.037	0.012	0.018
<b>Sulfur Content:</b> (wt. %)		<b>0.1</b>	0.0000	0.0100	0.004	0.004
<b>Distillation:</b>						
10% Point, (°C)		<b>Report</b>	200.0	238.0	221.5	220.8
50% Point, (°C)		<b>Report</b>	225.0	276.0	260.8	261.3
90% Point, (°C)		<b>357</b>	281.0	329.0	315.6	317.3
End Point, (°C)		<b>385</b>	319.0	358.0	345.6	347.5
Residue + Loss, (vol %)		<b>3.0</b>	1.2	2.9	2.16	2.31
<b>Flash Point:</b> (°C)	<b>60</b>		70.0	84.0	77.45	76.83
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)		<b>876</b>	843.8	874.8	865.1	865.5
<b>Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	<b>1.7</b>	<b>4.3</b>	1.891	3.728	3.014	3.086
<b>Cetane Index:</b> (calculated)	<b>43</b>		NR	NR	NR	NR
<b>Hydrogen Content:</b> (wt. %)	<b>12.5</b>		12.90	13.60	13.15	13.17
<b>Ash:</b> (wt. %)		<b>0.005</b>	0.0000	0.0040	0.0008	0.0005
<b>Cloud Point:</b> (°C)		<b>-1</b>	-50.0	-26.0	-30.5	-30.6
<b>Pour Point:</b> (°C)		<b>-6</b>	-69.0	-33.0	-40.5	-39.6
<b>Particulate Contamination:</b> (mg/L)		<b>10</b>	0.32	3.31	1.69	1.88
<b>Carbon Residue on 10% Bottoms:</b>						
D-524 (wt. %)		<b>0.20</b>	0.060	0.180	0.134	0.138
D-189 & D-4530 (wt. %)		<b>0.14</b>	NR	NR	NR	NR
<b>Demulsification:</b> (minutes @ 25 °C)		<b>10</b>	5.00	5.00	5.00	5.00
<b>Color:</b>		<b>3</b>	0.50	1.00	0.56	0.56
<b>Storage Stability:</b>						
D-2274 (mg/100mL)		<b>1.5</b>	0.10	1.00	0.38	0.39
D-5304 (mg/100mL)		<b>3.0</b>	NR	NR	NR	NR
<b>Calcium:</b> (ppm)		<b>1.0</b>	0.10	0.10	0.10	0.10
<b>Lead:</b> (ppm)		<b>0.5</b>	0.10	0.20	0.11	0.10
<b>Sodium + Potassium:</b> (ppm)		<b>1.0</b>	0.10	1.00	0.72	0.80
<b>Vanadium:</b> (ppm)		<b>0.5</b>	0.10	0.20	0.11	0.10

Table 7-4: Region 5 Summary

## 7. F76–2013 Regional Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)						
Property	Total Volume		147.97			
	Batch Analysis		26			
	Specification Limits		Region 6			
	Min	Max	Min	Max	Mean	Wt Mean
Acid Number: (mg KOH/g)		0.30	0.010	0.283	0.050	0.049
Sulfur Content: (wt. %)		0.1	0.0010	0.2800	0.107	0.111
Distillation:						
10% Point, (°C)	Report		193.0	235.0	208.3	209.0
50% Point, (°C)	Report		248.1	286.0	267.7	267.3
90% Point, (°C)	357		321.0	343.0	332.9	332.3
End Point, (°C)	385		352.0	378.0	365.6	365.1
Residue + Loss, (vol %)	3.0		1.3	2.5	1.95	1.95
Flash Point: (°C)	60		60.0	89.0	69.08	69.48
Density: (kg/m <sup>3</sup> @ 15 °C)		876	797.7	838.2	822.2	822.6
Viscosity: (mm <sup>2</sup> /s @ 40 °C)	1.7	4.3	2.275	3.416	2.776	2.774
Cetane Index: (calculated)	43		47.50	68.70	57.08	56.84
Hydrogen Content: (wt. %)	12.5		12.60	13.80	13.31	13.31
Ash: (wt. %)		0.005	0.0010	0.0010	0.0010	0.0010
Cloud Point: (°C)		-1	-12.0	-1.0	-5.0	-5.1
Pour Point: (°C)		-6	-18.0	-6.0	-12.1	-12.4
Particulate Contamination: (mg/L)		10	1.00	8.50	3.49	3.38
Carbon Residue on 10% Bottoms:						
D-524 (wt. %)	0.20		NR	NR	NR	NR
D-189 & D-4530 (wt. %)	0.14		0.010	0.030	0.022	0.022
Demulsification: (minutes @ 25 °C)		10	1.00	5.00	2.81	2.80
Color:		3	0.50	1.50	0.88	0.91
Storage Stability:						
D-2274 (mg/100mL)	1.5		NR	NR	NR	NR
D-5304 (mg/100mL)	3.0		0.07	2.10	1.39	1.41
Calcium: (ppm)		1.0	0.10	1.00	0.34	0.34
Lead: (ppm)		0.5	0.10	0.50	0.24	0.24
Sodium + Potassium: (ppm)		1.0	0.10	1.00	0.38	0.38
Vanadium: (ppm)		0.5	0.10	0.50	0.22	0.22

Table 7-5: Region 6 Summary

# 7. F76–2013 Regional Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)						
Property	Total Volume		50.62			
	Batch Analysis		17			
	Specification Limits		Region 7			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Acid Number:</b> (mg KOH/g)		<b>0.30</b>	0.050	0.290	0.183	0.167
<b>Sulfur Content:</b> (wt. %)		<b>0.1</b>	0.0480	0.4420	0.150	0.149
<b>Distillation:</b>						
10% Point, (°C)		<b>Report</b>	207.0	240.9	225.1	224.5
50% Point, (°C)		<b>Report</b>	271.0	290.7	281.8	282.2
90% Point, (°C)		<b>357</b>	339.5	349.0	344.2	344.7
End Point, (°C)		<b>385</b>	368.0	375.0	371.3	371.4
Residue + Loss, (vol %)		<b>3.0</b>	0.8	2.3	1.62	1.61
<b>Flash Point:</b> (°C)	<b>60</b>		62.0	73.0	66.71	67.20
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)		<b>876</b>	840.9	855.9	848.9	848.2
<b>Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	<b>1.7</b>	<b>4.3</b>	2.788	3.937	3.496	3.508
<b>Cetane Index:</b> (calculated)	<b>43</b>		48.50	52.30	50.44	50.74
<b>Hydrogen Content:</b> (wt. %)	<b>12.5</b>		13.05	13.83	13.31	13.35
<b>Ash:</b> (wt. %)		<b>0.005</b>	0.0020	0.0050	0.0033	0.0033
<b>Cloud Point:</b> (°C)		<b>-1</b>	-5.0	-1.0	-2.1	-2.2
<b>Pour Point:</b> (°C)		<b>-6</b>	-12.0	-6.0	-8.4	-9.1
<b>Particulate Contamination:</b> (mg/L)		<b>10</b>	1.10	7.10	2.80	2.71
<b>Carbon Residue on 10% Bottoms:</b>						
D-524 (wt. %)		<b>0.200</b>	NR	NR	NR	NR
D-189 & D-4530 (wt. %)		<b>0.140</b>	0.010	0.140	0.066	0.060
<b>Demulsification:</b> (minutes @ 25 °C)		<b>10</b>	1.00	2.00	1.40	1.38
<b>Color:</b>		<b>3</b>	1.00	2.00	1.35	1.32
<b>Storage Stability:</b>						
D-2274 (mg/100mL)		<b>1.5</b>	0.44	1.30	0.65	0.53
D-5304 (mg/100mL)		<b>3.0</b>	0.20	2.20	1.30	1.29
<b>Calcium:</b> (ppm)		<b>1.0</b>	0.10	1.00	0.25	0.22
<b>Lead:</b> (ppm)		<b>0.5</b>	0.00	0.50	0.18	0.16
<b>Sodium + Potassium:</b> (ppm)		<b>1.0</b>	0.00	1.00	0.35	0.31
<b>Vanadium:</b> (ppm)		<b>0.5</b>	0.00	0.50	0.12	0.11

Table 7-6: Region 7 Summary

## 7. F76–2013 Regional Data Summary

MIL-DTL-16884 Fuel, Naval Distillate (NATO Code F-76)						
Property	Total Volume		46.34			
	Batch Analysis		9			
	Specification Limits		Region 8			
	Min	Max	Min	Max	Mean	Wt Mean
Acid Number: (mg KOH/g)		0.30	0.003	0.295	0.072	0.035
Sulfur Content: (wt. %)		0.1	0.0420	0.3790	0.160	0.102
Distillation:						
10% Point, (°C)		Report	205.4	268.5	238.8	231.5
50% Point, (°C)		Report	268.0	294.8	283.2	279.0
90% Point, (°C)		357	321.7	338.2	331.3	333.2
End Point, (°C)		385	346.8	366.0	358.4	361.4
Residue + Loss, (vol %)		3.0	0.7	2.5	1.42	1.33
Flash Point: (°C)	60		64.0	91.0	79.78	77.01
Density: (kg/m <sup>3</sup> @ 15 °C)	876		842.3	850.4	845.3	844.0
Viscosity: (mm <sup>2</sup> /s @ 40 °C)	1.7	4.3	2.713	4.020	3.443	3.308
Cetane Index: (calculated)	43		50.10	54.50	52.16	52.45
Hydrogen Content: (wt. %)	12.5		13.00	15.90	13.99	14.41
Ash: (wt. %)		0.005	0.0010	0.0013	0.0011	0.0011
Cloud Point: (°C)		-1	-8.0	-1.0	-4.9	-4.5
Pour Point: (°C)		-6	-15.0	-6.0	-9.0	-8.6
Particulate Contamination: (mg/L)		10	0.10	1.80	0.79	0.97
Carbon Residue on 10% Bottoms:						
D-524 (wt. %)		0.200	NR	NR	NR	NR
D-189 & D-4530 (wt. %)		0.140	0.001	0.022	0.010	0.010
Demulsification: (minutes @ 25 °C)		10	1.00	5.00	2.67	2.20
Color:		3	0.50	1.50	0.78	0.65
Storage Stability:						
D-2274 (mg/100mL)		1.5	0.00	0.40	0.20	0.20
D-5304 (mg/100mL)		3.0	0.30	0.90	0.63	0.69
Calcium: (ppm)		1.0	0.00	1.00	0.28	0.32
Lead: (ppm)		0.5	0.00	0.50	0.16	0.18
Sodium + Potassium: (ppm)		1.0	0.00	1.00	0.33	0.37
Vanadium: (ppm)		0.5	0.00	0.50	0.16	0.18

Table 7-7: Region 8 Summary

## 7. F76—Assessment Summary

### ***Overview:***

In 2013, 89 reported analyses, representing 365.61 million U.S. gallons of F76, were processed by Regions 3, 5, 6, 7, and 8. This represents a decrease from the 118 reported F76 analyses and the 507.04 million U.S. gallons queried from the PQIS in 2012.

### ***Significant Trending:***

**Sulfur Content.** The weighted mean decreased 0.20 weight percent from 2011 to 2013.

**Distillation Residue + Loss.** The weighted mean increased 0.13 volume percent from 2010 to 2013.

**Flash Point.** The weighted mean increased 3.3 °C from 2010 to 2013.

**Density.** The weighted mean decreased 7.3 kg/m<sup>3</sup> @ 15 °C from 2012 to 2013 to a 13-year low of 838.5 kg/m<sup>3</sup> @ 15 °C after having increased 3.2 kg/m<sup>3</sup> @ 15 °C from 2011 to 2012.

**Viscosity.** The weighted mean increased 0.252 mm<sup>2</sup>/s @ 40 °C from 2010 to 2013 after having decreased 0.354 mm<sup>2</sup>/s @ 40 °C from 2008 to 2010.

**Cloud Point.** The weighted mean decreased 1.7 °C from 2011 to 2013.

**Pour Point.** The weighted mean decreased 1.5 °C from 2011 to 2013.

**Carbon Residue on 10% Bottoms (D-524).** The weighted mean increased 0.041 weight percent from 2011 to 2013.

**Storage Stability (D-2274).** The weighted mean decreased 0.38 mg/100 mL from 2011 to 2013.

### ***F76 Observations:***

All batches met specification requirements for 2013.

The MIL-DTL-16884 **Sulfur Content** maximum limit was changed to 0.1 mass percent in August 2012. Ten values that exceeded the new maximum limit were procured against the prior specification limit of 0.5 mass percent. These values were within the limits established by the prior specification.

## 7. F76 Data

### Acid Number—2013

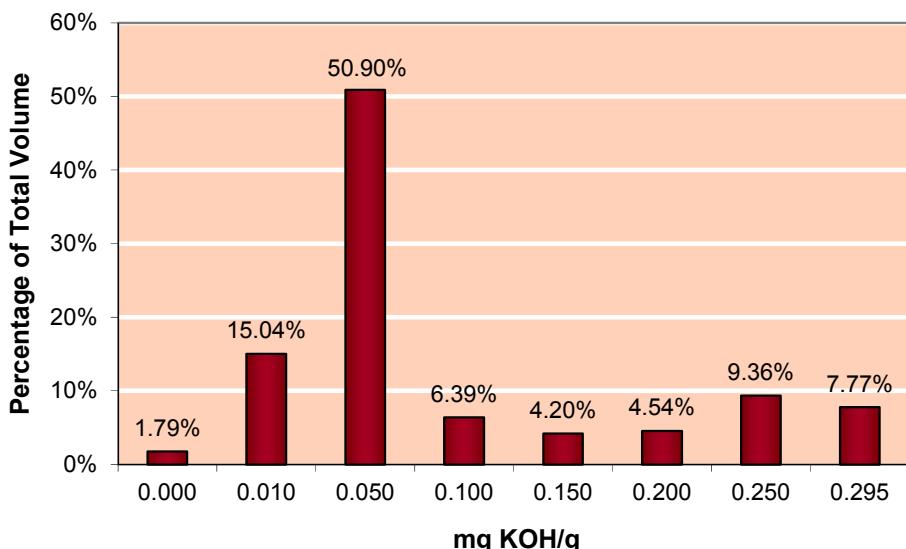


Figure 7-1: Acid Number (mg KOH/g), maximum 0.30

### Acid Number 13-Year Trend—Weighted Mean

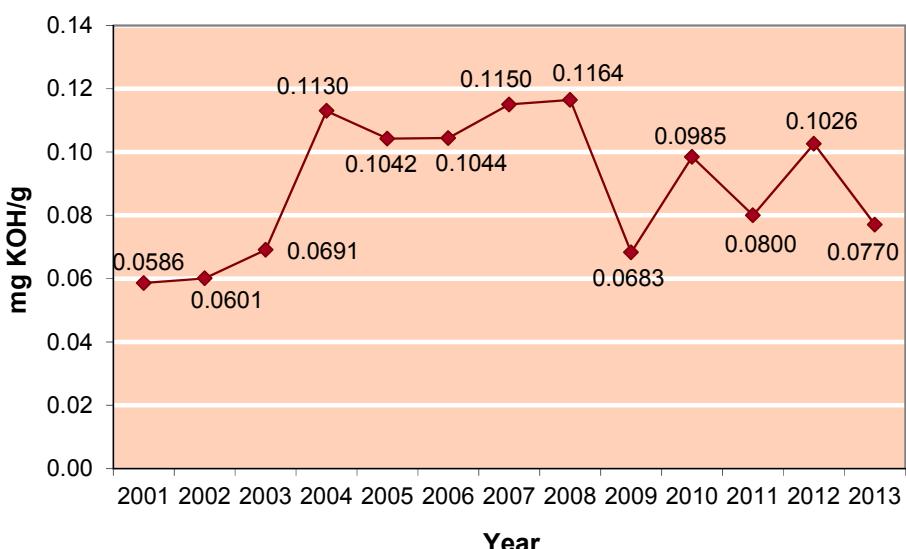


Figure 7-2: Acid Number (mg KOH/g), 13-Year Trend, maximum 0.30

### Sulfur Content—2013

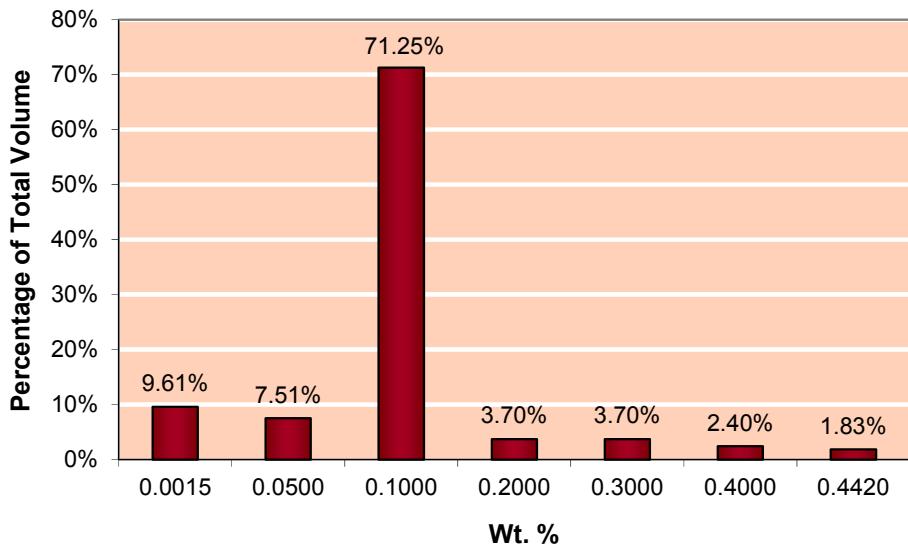


Figure 7-3: Sulfur Content (wt. %), maximum 0.1

### Sulfur Content 10-Year Trend—Weighted Mean

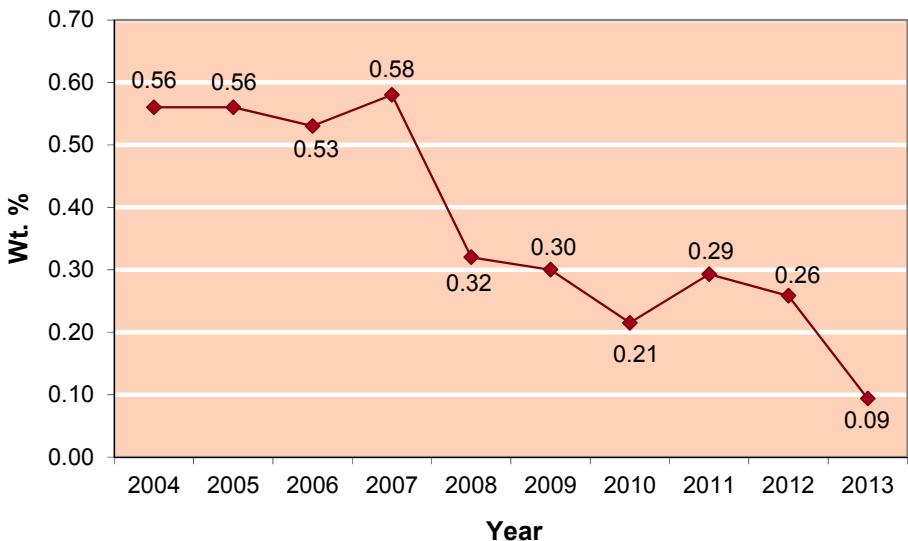


Figure 7-4: Sulfur Content (wt. %), 10-Year Trend, maximum 0.1

## 7. F76 Data

Distillation 10% Point—2013

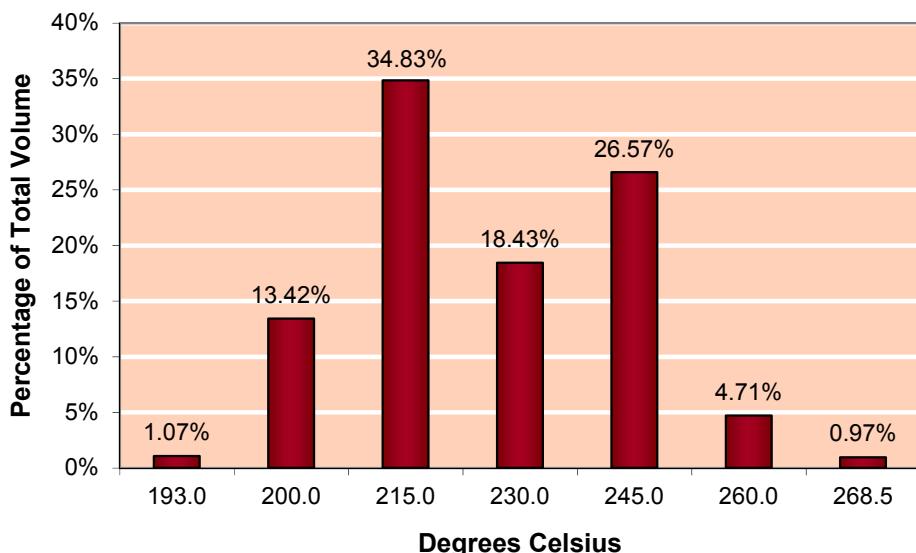


Figure 7-5: Distillation 10% Point (°C), Report

Distillation 50% Point—2013

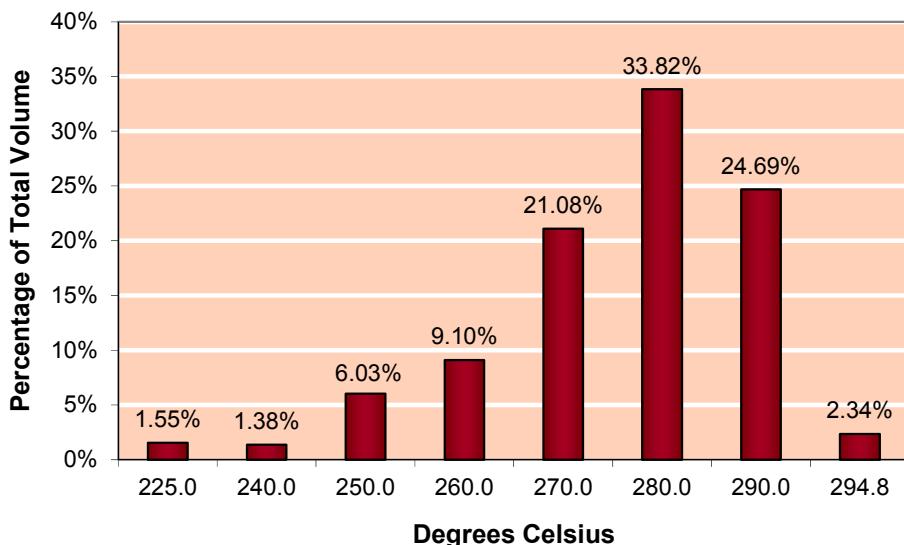


Figure 7-6: Distillation 50% Point (°C), Report

### Distillation 90% Point—2013

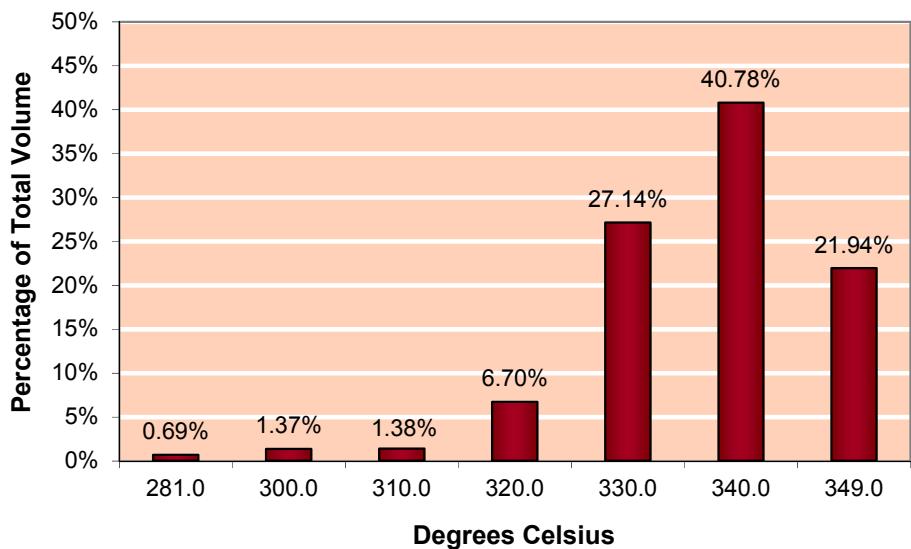


Figure 7-7: Distillation 90% Point (°C), maximum 357

### Distillation End Point—2013

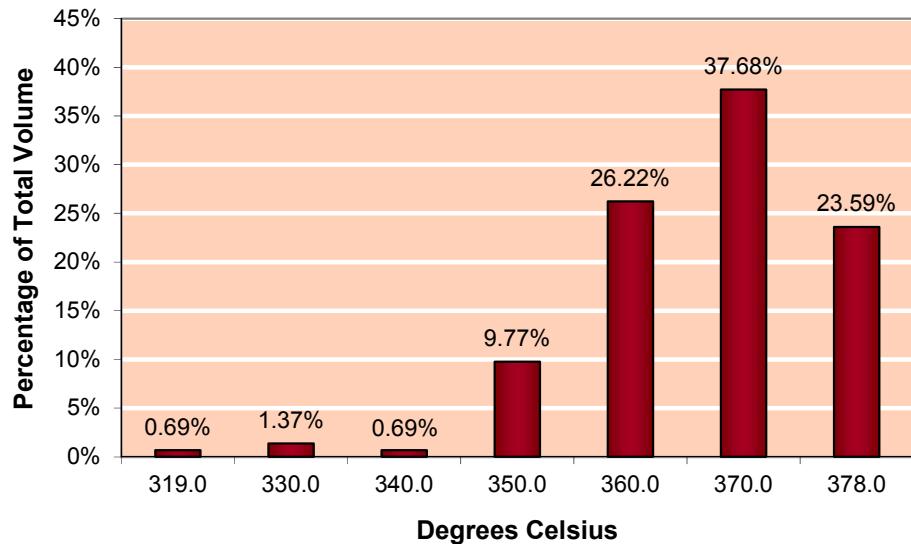


Figure 7-8: Distillation End Point (°C), maximum 385

## 7. F76 Data

### Distillation Residue + Loss—2013

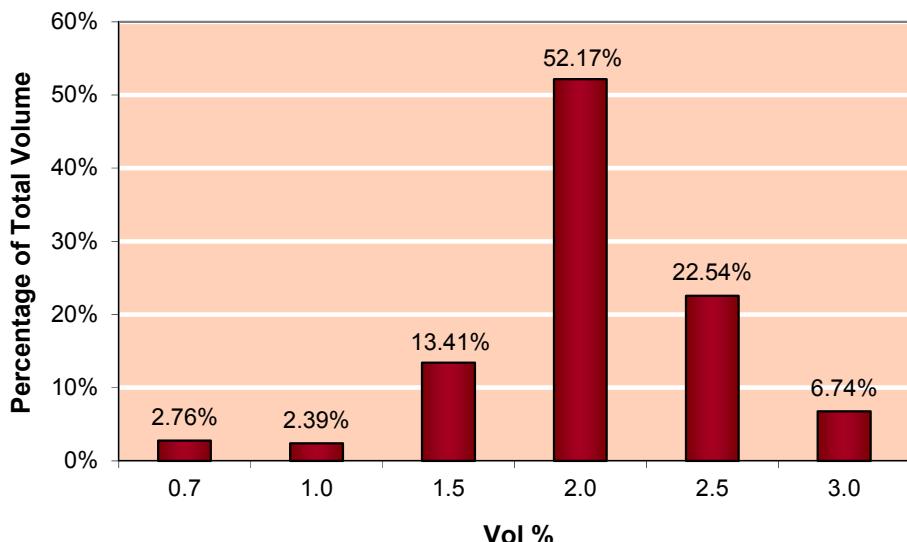


Figure 7-9: Distillation Residue + Loss (vol %), maximum 3.0

### Distillation Residue + Loss 9-Year Trend—Weighted Mean

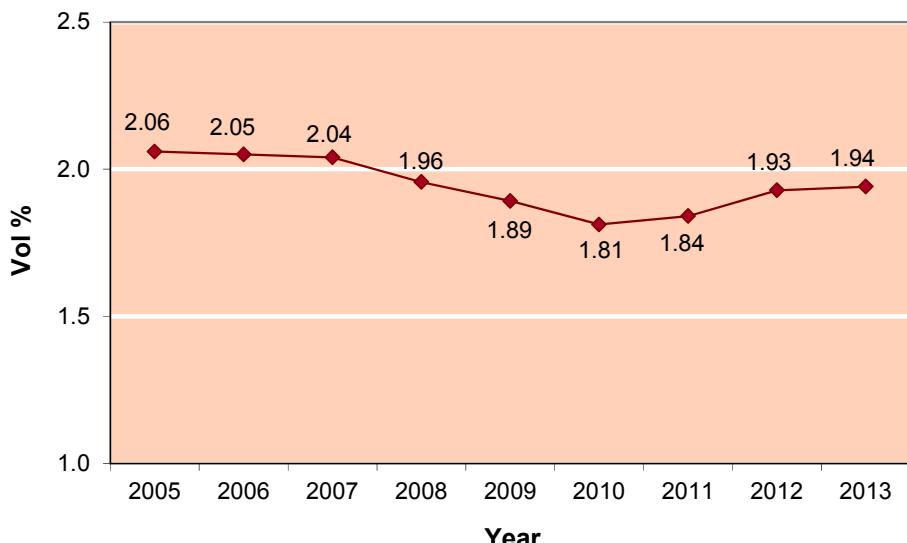


Figure 7-10: Distillation Residue + Loss (vol %), 9-Year Trend, maximum 3.0

## Flash Point—2013

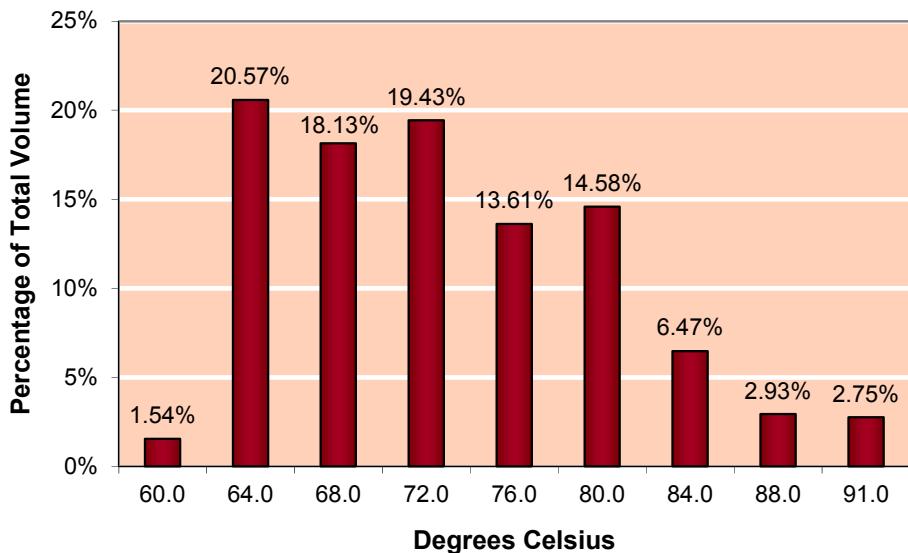


Figure 7-11: Flash Point (°C), minimum 60

## Flash Point 13-Year Trend—Weighted Mean

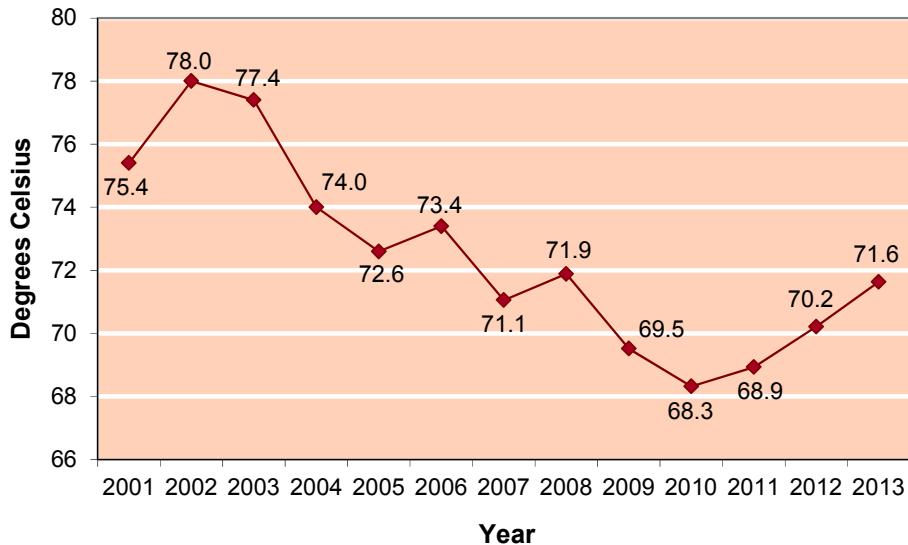


Figure 7-12: Flash Point (°C), 13-Year Trend, minimum 60

## 7. F76 Data

### Density—2013

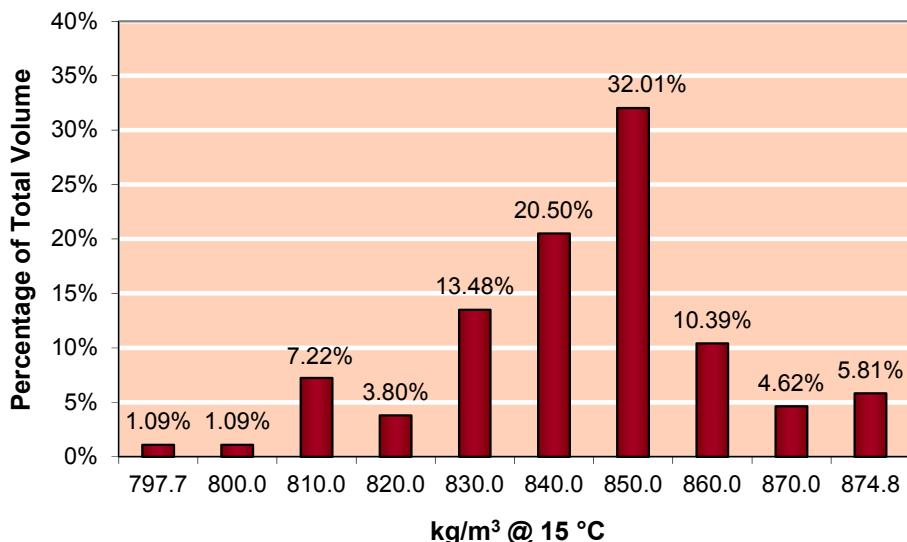


Figure 7-13: Density (kg/m<sup>3</sup> @ 15 °C), maximum 876

### Density 13-Year Trend—Weighted Mean

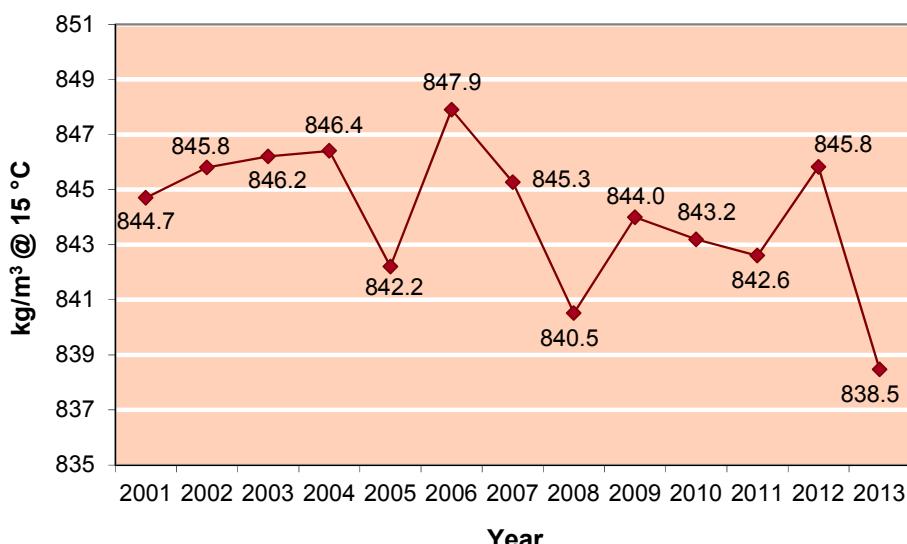
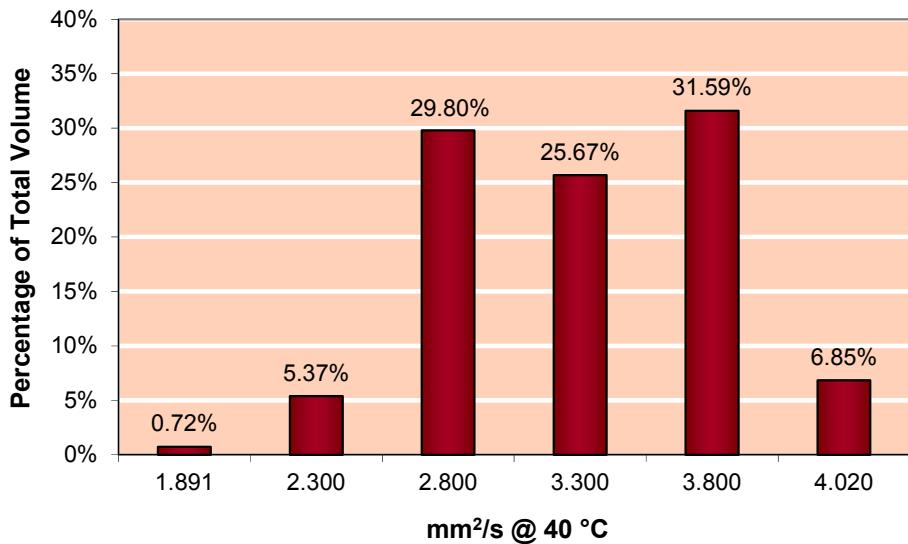
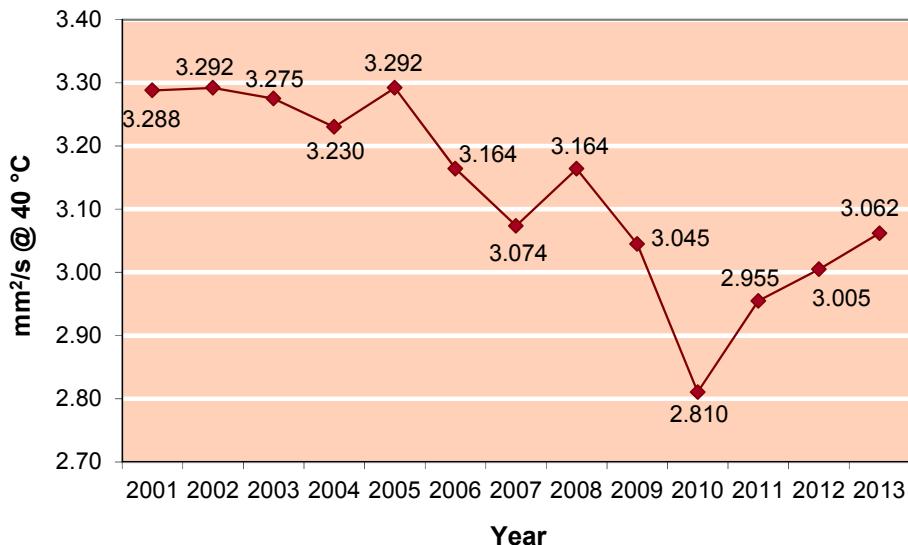


Figure 7-14: Density (kg/m<sup>3</sup> @ 15 °C), 13-Year Trend, maximum 876

## Viscosity—2013

Figure 7-15: Viscosity (mm<sup>2</sup>/s @ 40 °C), minimum 1.7, maximum 4.3

## Viscosity 13-Year Trend—Weighted Mean

Figure 7-16: Viscosity (mm<sup>2</sup>/s @ 40 °C), 13-Year Trend, minimum 1.7, maximum 4.3

## 7. F76 Data

### Cetane Index (Calculated)—2013

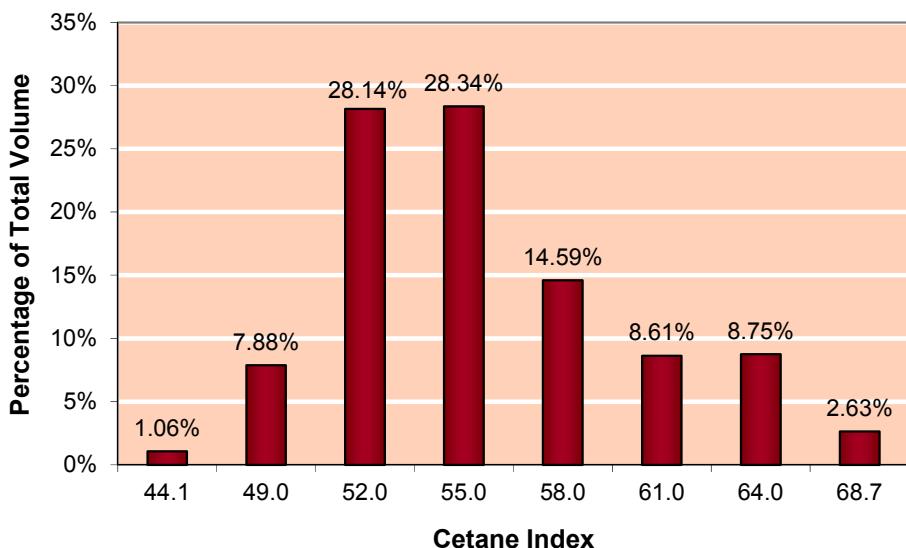


Figure 7-17: Cetane Index (Calculated), minimum 43

### Cetane Index 13-Year Trend—Weighted Mean

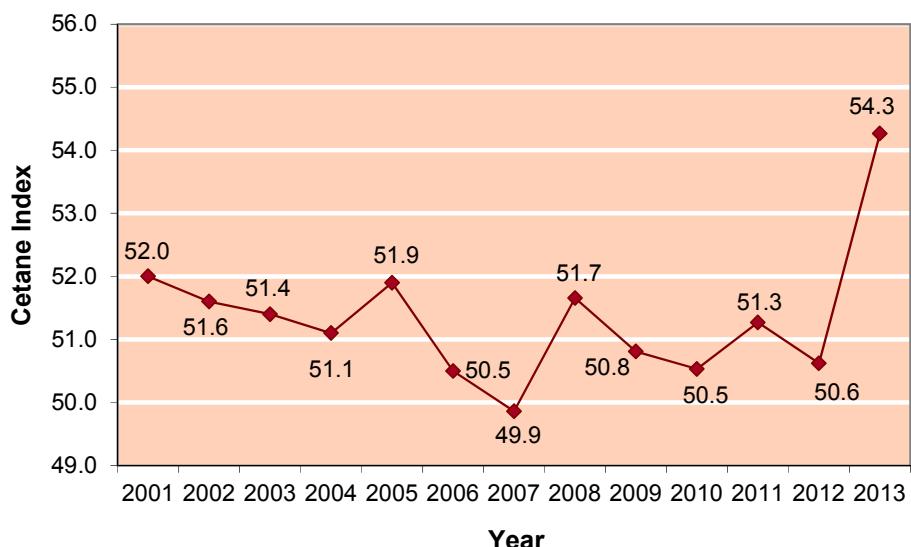


Figure 7-18: Cetane Index (Calculated), 13-Year Trend, minimum 43

## Hydrogen Content—2013

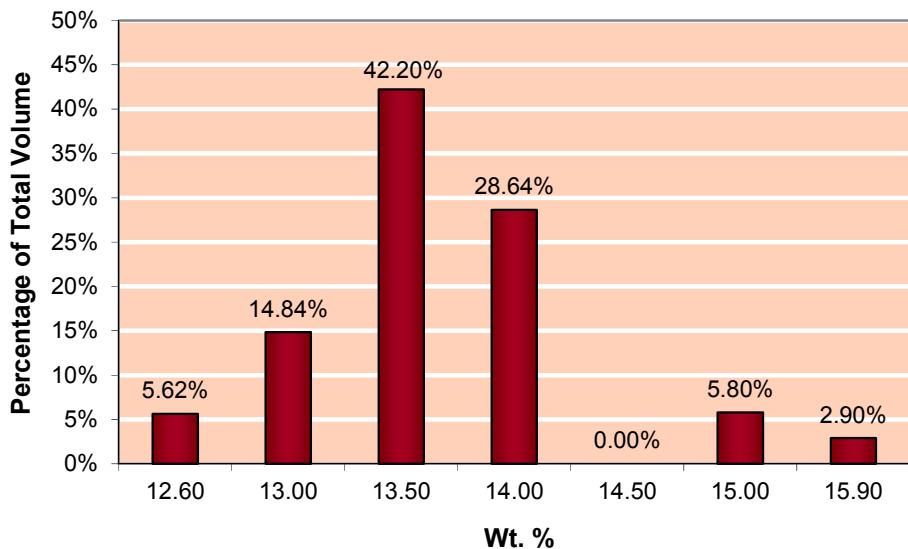


Figure 7-19: Hydrogen Content (wt. %), minimum 12.5

## Ash—2013

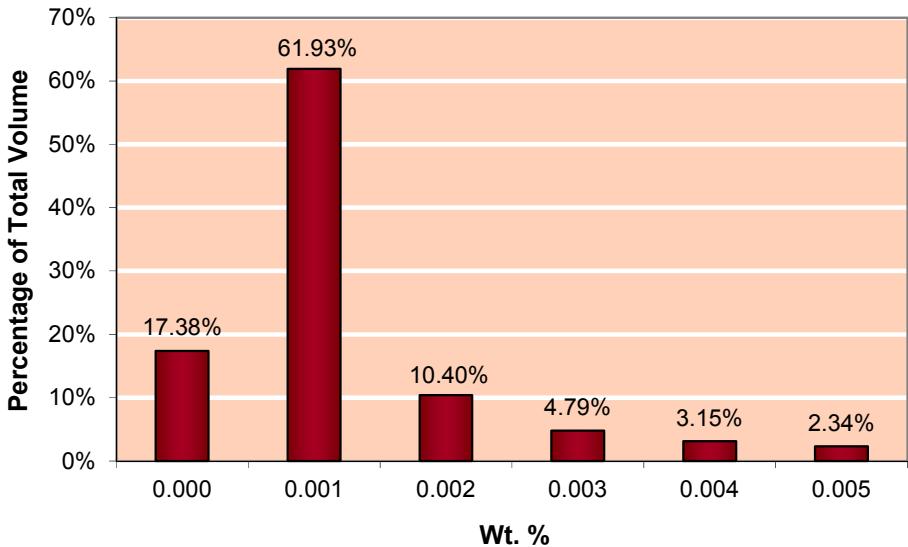


Figure 7-20: Ash (wt. %), maximum 0.005

## 7. F76 Data

### Cloud Point—2013

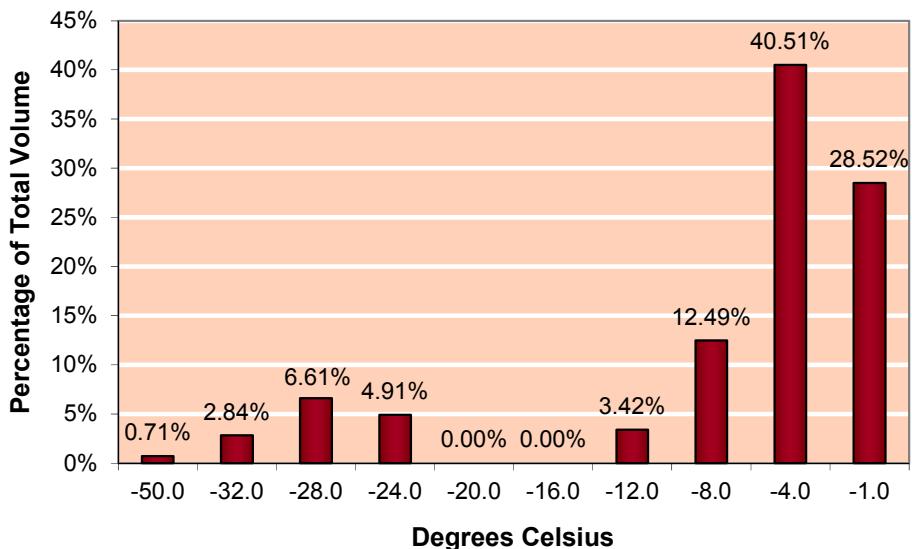


Figure 7-21: Cloud Point (°C), maximum –1

### Cloud Point 10-Year Trend—Weighted Mean

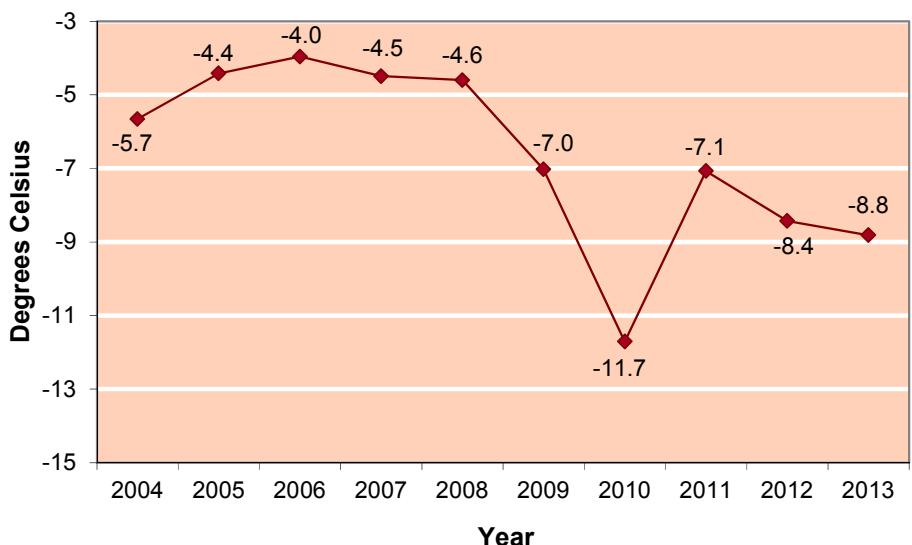


Figure 7-22: Cloud Point (°C), 10-Year Trend, maximum –1

## Pour Point—2013

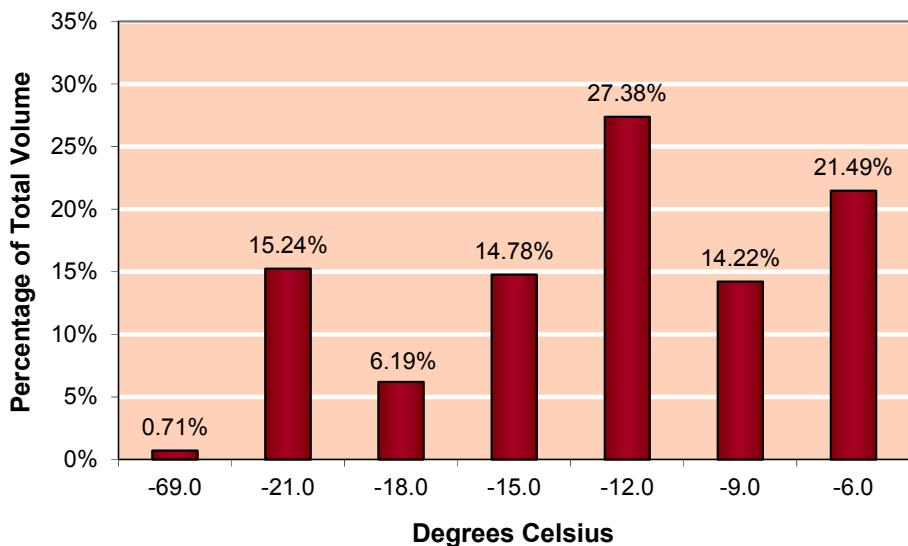


Figure 7-23: Pour Point (°C), maximum –6

## Pour Point 10-Year Trend—Weighted Mean

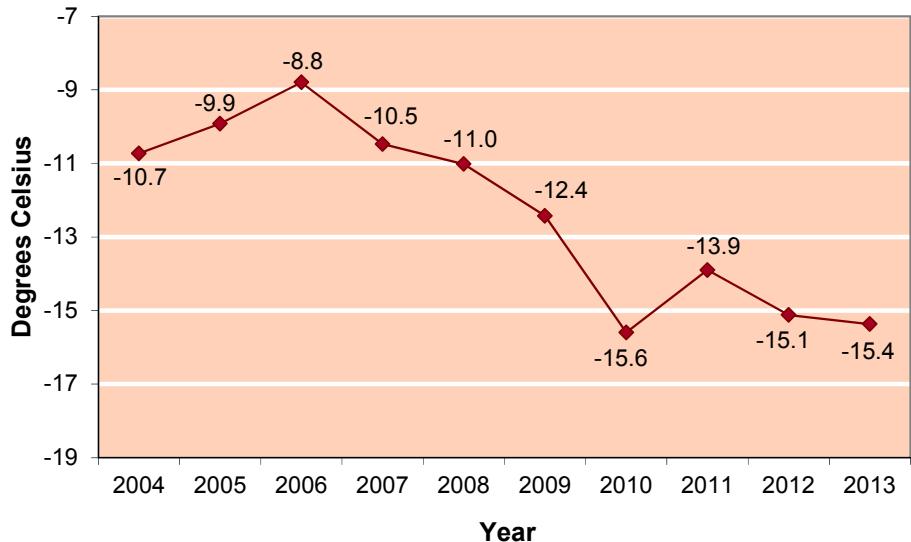


Figure 7-24: Pour Point (°C), 10-Year Trend, maximum –6

## 7. F76 Data

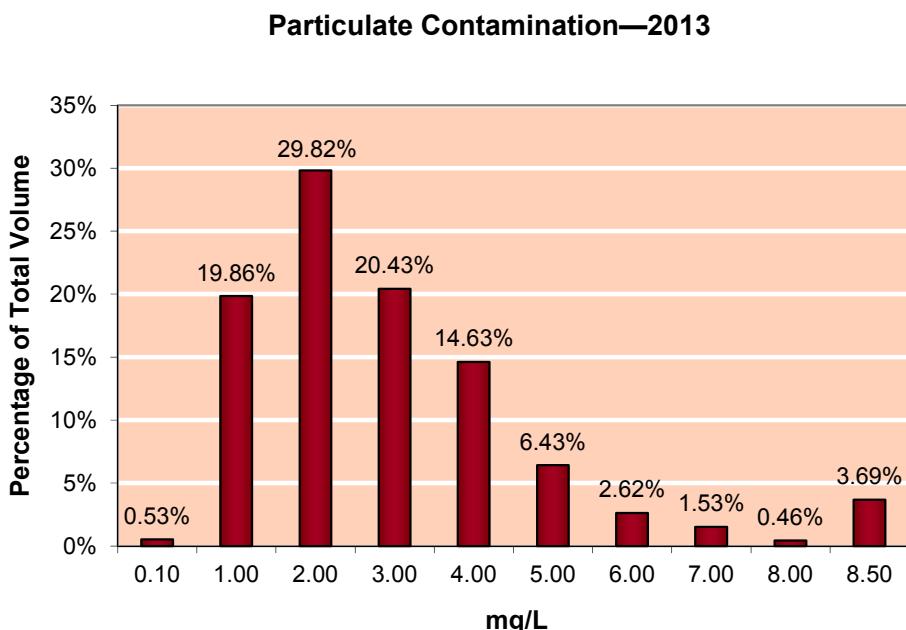


Figure 7-25: Particulate Contamination (mg/L), maximum 10

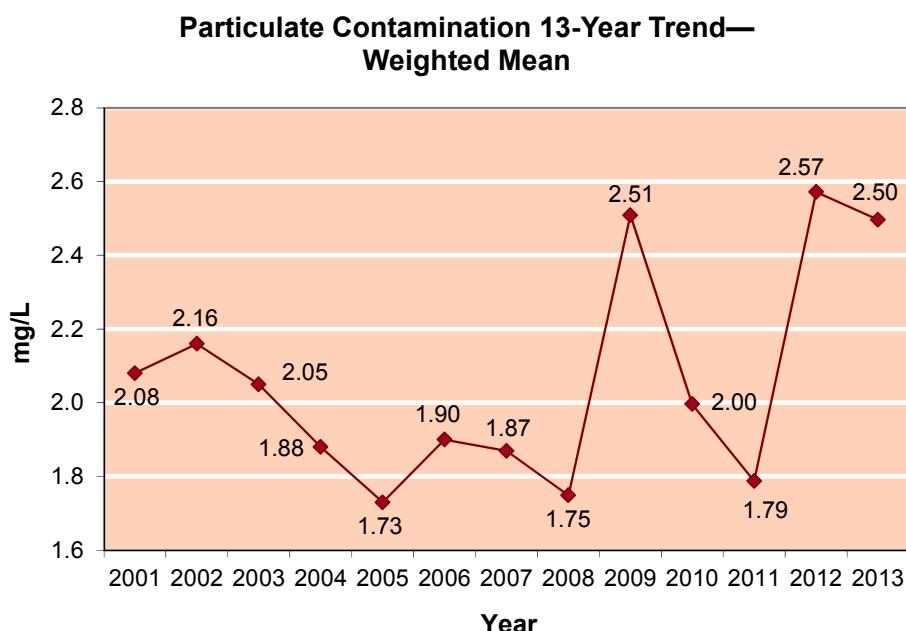


Figure 7-26: Particulate Contamination (mg/L), 13-Year Trend, maximum 10

### Carbon Residue on 10% Bottoms—2013 (Method ASTM D-524)

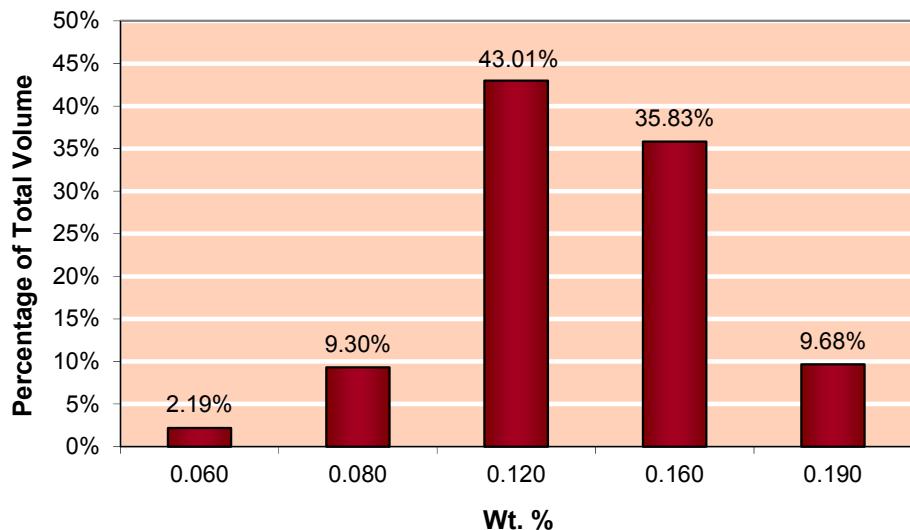


Figure 7-27: Carbon Residue on 10% Bottoms: D-524 (wt. %), maximum 0.20

### Carbon Residue on 10% Bottoms 7-Year Trend— Weighted Mean (Method ASTM D-524)

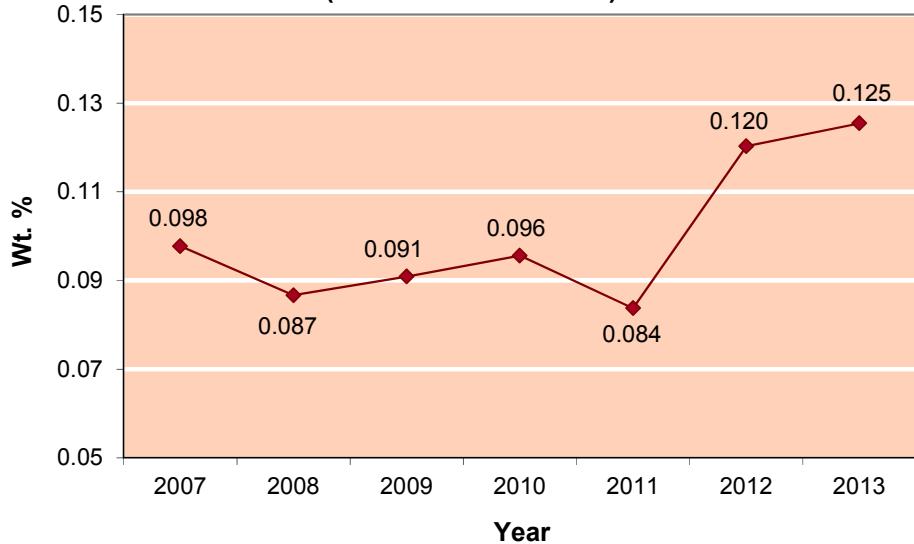


Figure 7-28: Carbon Residue on 10% Bottoms: D-524 (wt. %), 7-Year Trend, maximum 0.20

## 7. F76 Data

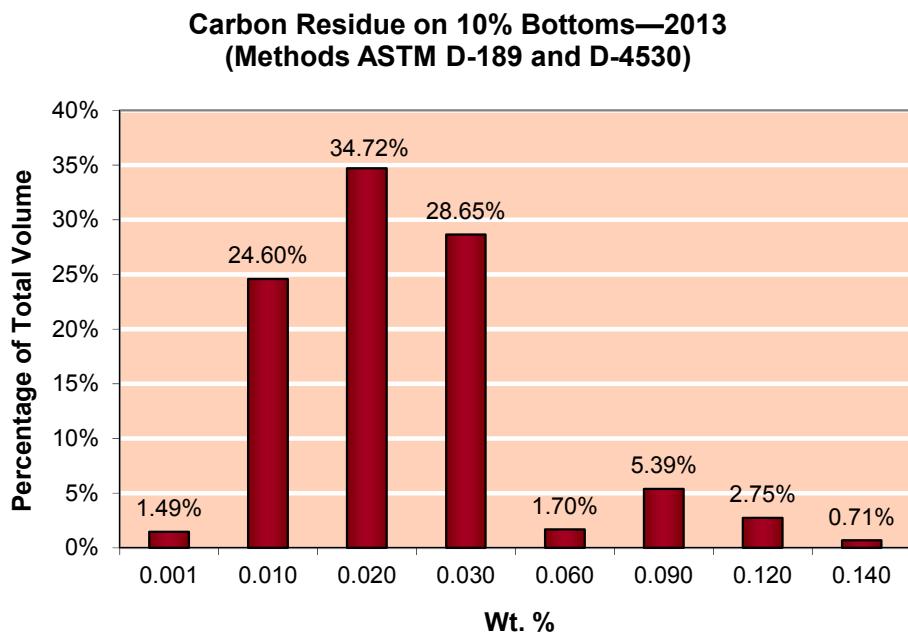


Figure 7-29: Carbon Residue on 10% Bottoms: D-189 and D-4530 (wt. %), maximum 0.14

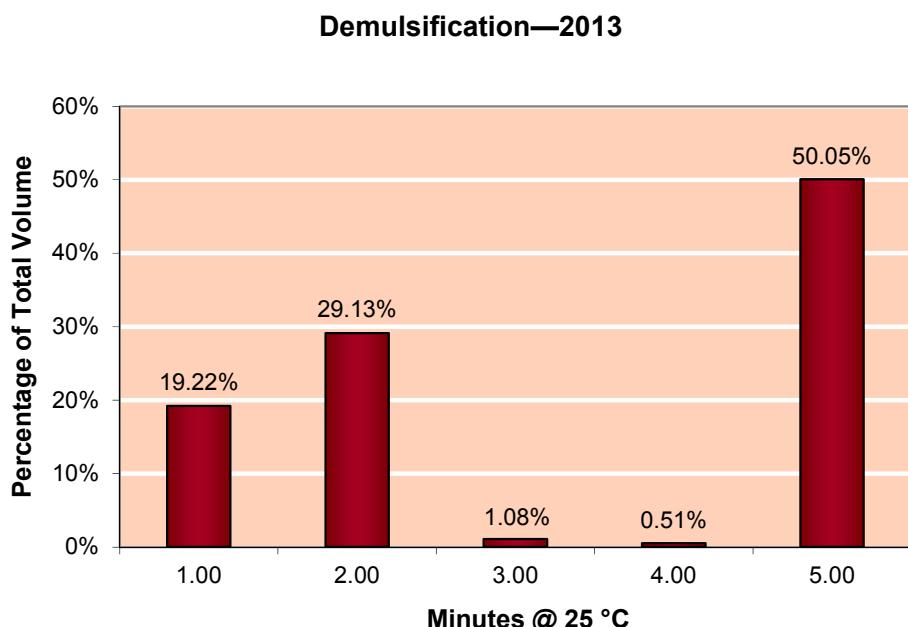


Figure 7-30: Demulsification (minutes @ 25 °C), maximum 10

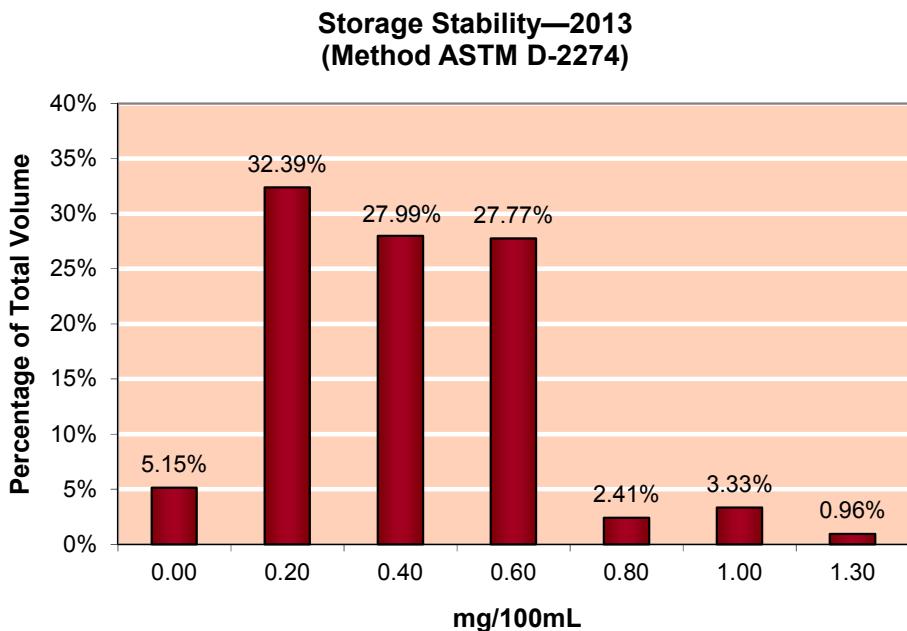


Figure 7-31: Storage Stability: D-2274 (mg/100 mL), maximum 1.5

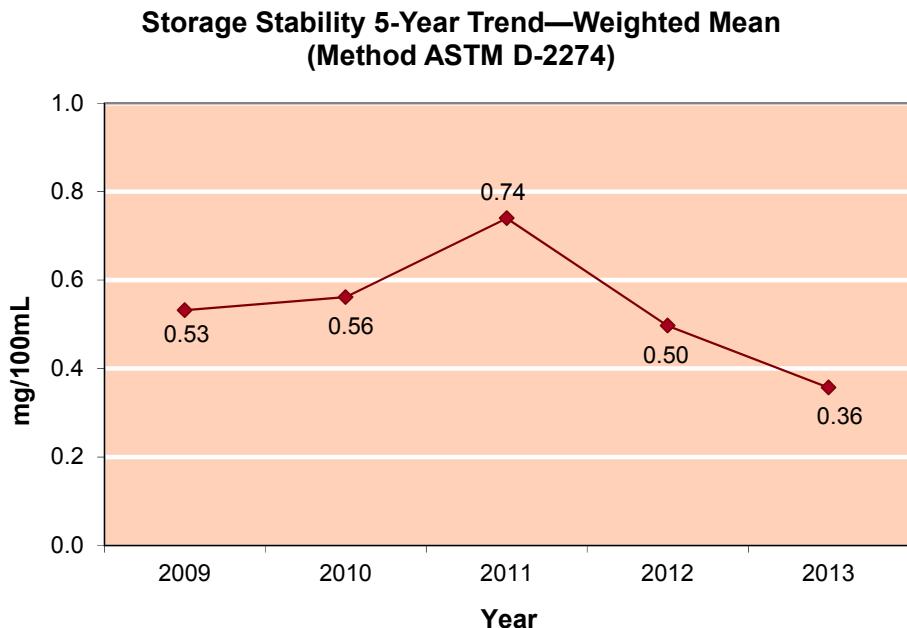


Figure 7-32: Storage Stability: D-2274 (mg/100 mL), 5-Year Trend, maximum 1.5

## 7. F76 Data

### Storage Stability—2013 (Method ASTM D-5304)

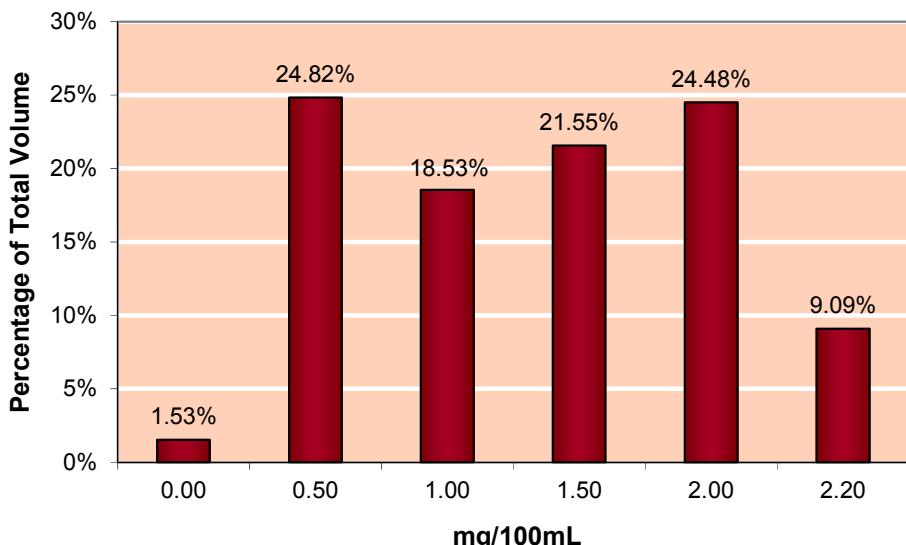


Figure 7-33: Storage Stability: D-5304 (mg/100 mL), maximum 3.0

### Storage Stability 5-Year Trend—Weighted Mean (Method ASTM D-5304)

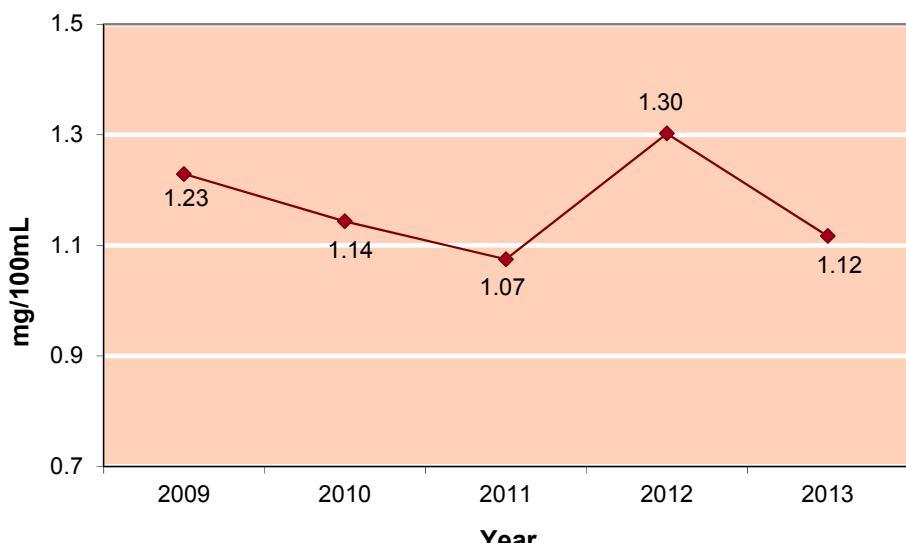


Figure 7-34: Storage Stability: D-5304 (mg/100 mL), 5-Year Trend, maximum 3.0



## 8. MGO—2013 Data Summary

<b>Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)</b>			
<b>Property</b>	<b>2013 Source Inputs</b>		
	<b>Region</b>	<b>Volume</b>	<b>Batch</b>
<b>Cetane Index:</b> (calculated)	All	2.986	138
<b>Pour Point:</b> <sup>1</sup> (°C)	All	3.017	142
<b>Flash Point:</b> (°C)	All	3.048	143
<b>Kinematic Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	All	3.048	143
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)	All	3.048	143
<b>Carbon Residue (10% Bottoms), D-4530:</b> (mass %)	All	3.017	142
<b>Sulfur:</b> (mass %)	All	2.936	137
<b>Ash:</b> (mass%)	All	3.017	142
<b>Acid Number:</b> (mg KOH/g)	All	3.017	142
<b>Oxidation Stability:</b> <sup>2</sup> (mg/100mL)	All	2.955	137
<b>FAME:</b> (vol %)	All	3.048	143
<b>Lubricity, corrected wear scar diameter @ 60 °C:</b> <sup>3</sup> (µm)	All	3.017	142
<b>Cloud Point:</b> (°C)	All	2.955	137
<b>Particulate Contamination:</b> (mg/L)	All	2.940	136

Table 8-1: Data Summary, ISO-8217, Marine Gas Oil, Grade DMA Requirements, 2013 Source Inputs

## 8. MGO—2013 Data Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Specification Limits		2013 Test Results			
	Min	Max	Min	Max	Mean	Wt Mean
Cetane Index: (calculated)	40		40.0	61.5	48.5	48.2
Pour Point: <sup>1</sup> (°C)		–6 or 0	–24.0	–3.0	–18.4	–18.4
Flash Point: (°C)	60		52.0	111.0	66.6	67.5
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	1.884	4.593	2.767	2.803
Density: (kg/m <sup>3</sup> @ 15 °C)		890	822.7	869.3	845.1	845.6
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.010	0.210	0.0252	0.0236
Sulfur: (mass %)		1.0	0.00023	0.45100	0.035	0.028
Ash: (mass%)		0.010	0.000	0.014	0.0005	0.0004
Acid Number: (mg KOH/g)		0.5	0.100	0.150	0.102	0.102
Oxidation Stability: <sup>2</sup> (mg/100mL)		25	0.0	12.2	1.15	1.04
FAME: (vol %)		0.5	0.05	4.94	0.11	0.09
Lubricity, corrected wear scar diameter @ 60 °C: <sup>3</sup> (µm)		520	180.0	640.0	413.1	405.9
Cloud Point: (°C)	Note 4		–26.0	4.0	–11.2	–11.6
Particulate Contamination: (mg/L)	Note 4		0.00	25.00	2.16	2.67

Table 8-2: Data Summary, ISO-8217, Marine Gas Oil, Grade DMA Requirements, 2013 Test Results

**Note 1:** Pour Point winter quality maximum limit equals –6 °C, while the summer quality maximum limit equals 0 °C.

**Note 2:** The MGO Oxidation Stability unit of measure and data are from the F76 specification and not the ISO specification. The ISO specification defines units of g/m<sup>3</sup> using ISO 12205, and the F76 specification is mg/100mL using ASTM D5304.

**Note 3:** The requirement applies to fuels with sulfur content below 0.050 mass %.

**Note 4:** Cloud Point and Particulate Contamination are not part of the ISO specification, but part of the F76 specification. Both properties have been included in the MGO tables and figures for informational purposes.

## 8. MGO—2013 Regional Data Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Total Volume		0.690			
	Batch Analysis		37			
	Specification Limits		Region 1			
	Min	Max	Min	Max	Mean	Wt Mean
Cetane Index: (calculated)	40		44.3	55.5	48.7	48.6
Pour Point: (°C)		-6 or 0	-21.0	-12.0	-19.5	-19.8
Flash Point: (°C)	60		55.0	77.5	63.3	62.9
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	2.278	4.593	2.575	2.741
Density: (kg/m <sup>3</sup> @ 15 °C)	890		828.7	850.3	840.8	840.9
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.010	0.210	0.0249	0.0313
Sulfur: (mass %)		1.0	0.00047	0.27600	0.0193	0.0157
Ash: (mass %)	0.010		0.000	0.011	0.0005	0.0004
Acid Number: (mg KOH/g)		0.5	0.100	0.150	0.101	0.102
Oxidation Stability: (mg/100mL)		25	0.1	4.0	1.16	1.18
FAME: (vol %)		0.5	0.05	4.94	0.21	0.16
Lubricity, corrected wear scar diameter @ 60 °C: (μm)		520	180.0	580.0	399.2	409.3
Cloud Point: (°C)	None Specified		-17.0	-5.0	-10.4	-10.5
Particulate Contamination: (mg/L)	None Specified		0.50	25.00	2.68	3.06

Table 8-3: Region 1 Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Total Volume		0.574			
	Batch Analysis		29			
	Specification Limits		Region 2			
	Min	Max	Min	Max	Mean	Wt Mean
Cetane Index: (calculated)	40		42.0	51.4	45.7	45.8
Pour Point: (°C)		-6 or 0	-21.0	-12.0	-20.5	-20.3
Flash Point: (°C)	60		52.0	89.0	65.4	64.7
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	2.297	3.462	2.787	2.763
Density: (kg/m <sup>3</sup> @ 15 °C)	890		834.9	862.8	852.2	851.1
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.010	0.100	0.0203	0.0197
Sulfur: (mass %)		1.0	0.00023	0.00140	0.0008	0.0008
Ash: (mass %)	0.010		0.000	0.001	0.0002	0.0002
Acid Number: (mg KOH/g)		0.5	0.100	0.100	0.100	0.100
Oxidation Stability: (mg/100mL)		25	0.1	2.6	0.95	0.88
FAME: (vol %)		0.5	0.05	0.10	0.05	0.05
Lubricity, corrected wear scar diameter @ 60 °C: (μm)		520	290.0	640.0	457.2	426.4
Cloud Point: (°C)	None Specified		-26.0	-5.0	-15.7	-15.4
Particulate Contamination: (mg/L)	None Specified		0.30	3.60	1.11	1.14

Table 8-4: Region 2 Summary

## 8. MGO—2013 Regional Data Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)					
Property	Total Volume		0.018		
	Batch Analysis		1		
	Specification Limits		Region 3		
	Min	Max	2013 Test Results		
Cetane Index: (calculated)	40		49.8		
Pour Point: (°C)		–6 or 0	–9.0		
Flash Point: (°C)	60		71.0		
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	3.105		
Density: (kg/m <sup>3</sup> @ 15 °C)		890	847.4		
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.100		
Sulfur: (mass %)		1.0	0.04650		
Ash: (mass %)		0.010	0.000		
Acid Number: (mg KOH/g)		0.5	0.100		
Oxidation Stability: (mg/100mL)		25	0.5		
FAME: (vol %)		0.5	0.05		
Lubricity, corrected wear scar diameter @ 60 °C: (μm)		520	220.0		
Cloud Point: (°C)	None Specified		–6.0		
Particulate Contamination: (mg/L)	None Specified		0.30		

Table 8-5: Region 3 Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Total Volume		0.526			
	Batch Analysis		20			
	Specification Limits		Region 5			
	Min	Max	Min	Max	Mean	Wt Mean
Cetane Index: (calculated)	40		40.0	54.1	47.6	46.1
Pour Point: (°C)		–6 or 0	–24.0	–9.0	–16.8	–17.6
Flash Point: (°C)	60		55.0	81.0	67.5	68.5
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	1.884	3.317	2.642	2.616
Density: (kg/m <sup>3</sup> @ 15 °C)		890	822.7	869.3	843.7	847.0
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.010	0.210	0.0345	0.0221
Sulfur: (mass %)		1.0	0.00050	0.27700	0.0173	0.0076
Ash: (mass %)		0.010	0.000	0.011	0.0011	0.0008
Acid Number: (mg KOH/g)		0.5	0.100	0.100	0.100	0.100
Oxidation Stability: (mg/100mL)		25	0.2	2.0	0.71	0.62
FAME: (vol %)		0.5	0.05	0.85	0.10	0.08
Lubricity, corrected wear scar diameter @ 60 °C: (μm)		520	360.0	600.0	458.0	469.2
Cloud Point: (°C)	None Specified		–21.0	4.0	–11.3	–12.2
Particulate Contamination: (mg/L)	None Specified		0.00	10.00	2.20	2.22

Table 8-6: Region 5 Summary

## 8. MGO—2013 Regional Data Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Total Volume		0.498			
	Batch Analysis		11			
	Specification Limits		Region 8			
	Min	Max	Min	Max	Mean	Wt Mean
Cetane Index: (calculated)	40		43.9	61.5	52.2	52.3
Pour Point: (°C)		-6 or 0	-21.0	-9.0	-18.3	-17.0
Flash Point: (°C)	60		59.0	111.0	78.7	78.2
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	2.251	3.680	2.940	2.925
Density: (kg/m <sup>3</sup> @ 15 °C)		890	832.1	847.0	840.1	839.9
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.010	0.100	0.0209	0.0189
Sulfur: (mass %)		1.0	0.00040	0.01080	0.0021	0.0030
Ash: (mass%)		0.010	0.000	0.001	0.0003	0.0002
Acid Number: (mg KOH/g)		0.5	0.100	0.100	0.100	0.100
Oxidation Stability: (mg/100mL)		25	0.2	3.2	0.99	0.99
FAME: (vol %)		0.5	0.05	0.07	0.05	0.05
Lubricity, corrected wear scar diameter @ 60 °C: (μm)		520	200.0	530.0	354.5	328.2
Cloud Point: (°C)	None Specified		-20.0	-4.0	-12.7	-11.5
Particulate Contamination: (mg/L)	None Specified		0.00	17.00	3.25	4.75

Table 8-7: Region 8 Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Total Volume		0.270			
	Batch Analysis		23			
	Specification Limits		Region 9			
	Min	Max	Min	Max	Mean	Wt Mean
Cetane Index: (calculated)	40		44.5	57.4	51.4	50.4
Pour Point: (°C)		-6 or 0	-21.0	-6.0	-18.3	-18.2
Flash Point: (°C)	60		58.0	80.0	67.7	67.0
Kinematic Viscosity: (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	2.188	3.509	2.753	2.719
Density: (kg/m <sup>3</sup> @ 15 °C)		890	824.8	869.1	839.9	841.2
Carbon Residue (10% Bottoms), D-4530: (mass %)		0.30	0.010	0.100	0.0230	0.0264
Sulfur: (mass %)		1.0	0.00043	0.13900	0.0216	0.0180
Ash: (mass%)		0.010	0.000	0.001	0.0001	0.0001
Acid Number: (mg KOH/g)		0.5	0.100	0.150	0.107	0.105
Oxidation Stability: (mg/100mL)		25	0.1	12.2	1.78	1.61
FAME: (vol %)		0.5	0.05	0.12	0.05	0.05
Lubricity, corrected wear scar diameter @ 60 °C: (μm)		520	260.0	550.0	393.9	398.0
Cloud Point: (°C)	None Specified		-14.0	-2.0	-8.5	-9.2
Particulate Contamination: (mg/L)	None Specified		0.00	6.80	1.64	1.94

Table 8-8: Region 9 Summary

## 8. MGO—2013 Regional Data Summary

Commercial Marine Gas Oil Minimum Specification Requirements (ISO-8217, Marine Gas Oil, Grade DMA)						
Property	Total Volume		0.472			
	Batch Analysis		22			
	Specification Limits		Region 10			
	Min	Max	Min	Max	Mean	Wt Mean
<b>Cetane Index:</b> (calculated)	40		43.9	55.1	47.5	47.3
<b>Pour Point:</b> (°C)		-6 or 0	-21.0	-3.0	-15.5	-16.8
<b>Flash Point:</b> (°C)	60		56.5	71.0	65.3	65.2
<b>Kinematic Viscosity:</b> (mm <sup>2</sup> /s @ 40 °C)	2.000	6.000	2.534	3.859	3.088	3.060
<b>Density:</b> (kg/m <sup>3</sup> @ 15 °C)		890	830.1	866.7	851.8	852.7
<b>Carbon Residue (10% Bottoms), D-4530:</b> (mass %)		0.30	0.010	0.150	0.0248	0.0191
<b>Sulfur:</b> (mass %)		1.0	0.00067	0.45100	0.1517	0.1373
<b>Ash:</b> (mass%)		0.010	0.000	0.014	0.0013	0.0007
<b>Acid Number:</b> (mg KOH/g)		0.5	0.100	0.150	0.105	0.108
<b>Oxidation Stability:</b> (mg/100mL)		25	0.0	5.2	1.23	1.23
<b>FAME:</b> (vol %)		0.5	0.05	0.97	0.09	0.11
<b>Lubricity, corrected wear scar diameter @ 60 °C: (µm)</b>		520	240.0	540.0	394.8	398.4
<b>Cloud Point:</b> (°C)	None Specified		-14.0	3.0	-8.5	-9.0
<b>Particulate Contamination:</b> (mg/L)	None Specified		0.20	9.80	2.77	2.74

Table 8-9: Region 10 Summary



## 8. MGO—Assessment Summary

### **Overview:**

MGO is continued for 2013, providing a detailed summary of test data by region. Histograms are provided for 2013 data only and were obtained solely from the PQIS database. Where significant trends were noted in weighted mean values, trend graphs were developed, providing a previous 13-year review.

The Coast Guard In-Line Sampling Program data represent dockside and vessel sampling for Ships' Bunkers program deliveries and open market purchases of MGO from various worldwide locations. Data provided were compared with ISO-8217 Grade DMA requirements and MIL-DTL-16884 criteria. The In-Line Sampling Program figures featured are based on these correlations and represent total analysis by year and the range of test failure occurrences for 2013 compared with these standards.

### **Significant Trending:**

**Flash Point.** Despite slight increases from 2007 to 2008 and from 2011 to 2012, the weighted mean has decreased 6.9 °C since 2004.

**Kinematic Viscosity.** Despite slight increases from 2005 to 2006 and from 2011 to 2012, the weighted mean has decreased 0.691 mm<sup>2</sup>/s @ 40 °C since 2004.

**Density.** The weighted mean decreased 8.7 kg/m<sup>3</sup> @ 15 °C from 2007 to 2013.

**Carbon Residue (10% Bottoms), D-4530.** The weighted mean increased 0.0109 mass percent since 2011.

**Sulfur.** Despite increases from 2009 to 2010 and from 2011 to 2012, the weighted mean has decreased 0.256 mass percent since 2006.

**Lubricity.** The weighted mean increased 40.9 µm since 2010.

### **MGO Observations:**

The following review applies only to In-Line Sampling Program activity critical test failure occurrences compared with ISO-8217 Grade DMA requirements and any additional Commercial Marine Gas Oil Minimum Specification requirements:

**Cetane Index.** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 138 samples tested.

**Pour Point.** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 142 samples tested. Pour Point winter quality maximum limit equals -6 °C, while the summer quality maximum limit equals 0 °C.

## 8. MGO—Assessment Summary

**Flash Point.** Fifteen failure occurrences were noted in 2013. This represents an 10.5 percent failure rate on the basis of the 143 samples tested.

**Kinematic Viscosity.** Two failure occurrences were noted in 2013. This represents a 1.4 percent failure rate on the basis of the 143 samples tested.

**Density.** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 143 samples tested.

**Carbon Residue, 10% btm (ASTM D4530).** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 142 samples tested.

**Sulfur.** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 137 samples tested.

**Ash.** Three failure occurrences were noted in 2013. This represents a 2.1 percent failure rate on the basis of the 142 samples tested.

**Acid Number.** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 142 samples tested.

**Oxidation Stability.** Zero failure occurrences were noted in 2013. This represents a 0.0 percent failure rate on the basis of the 137 samples tested.

**Fatty Acid Methyl Esters (FAME).** Four failure occurrences were noted in 2013. This represents a 2.8 percent failure rate on the basis of the 143 samples tested.

**Lubricity.** Seventeen failure occurrences were noted in 2013. This represents a 12.0 percent failure rate on the basis of the 142 samples tested.

**Appearance.** Sixteen failure occurrences were noted in 2013. This represents a 11.3 percent failure rate on the basis of the 142 samples tested.

The ISO-8217 Grade DMA requirements specify a 1.5 mass percent maximum limit for sulfur and a 0.1 volume percent maximum limit for FAME. Per Commercial Marine Gas Oil Minimum Specification Requirements (DLA Energy, October 2010), the maximum limit for sulfur is 1.0 mass percent. For FAME, the DLA Energy MGO clause has raised the maximum allowable contamination to 0.5 volume percent as a result of a Navy test program.

## 8. MGO Data

**Cetane Index (Calculated)—2013**

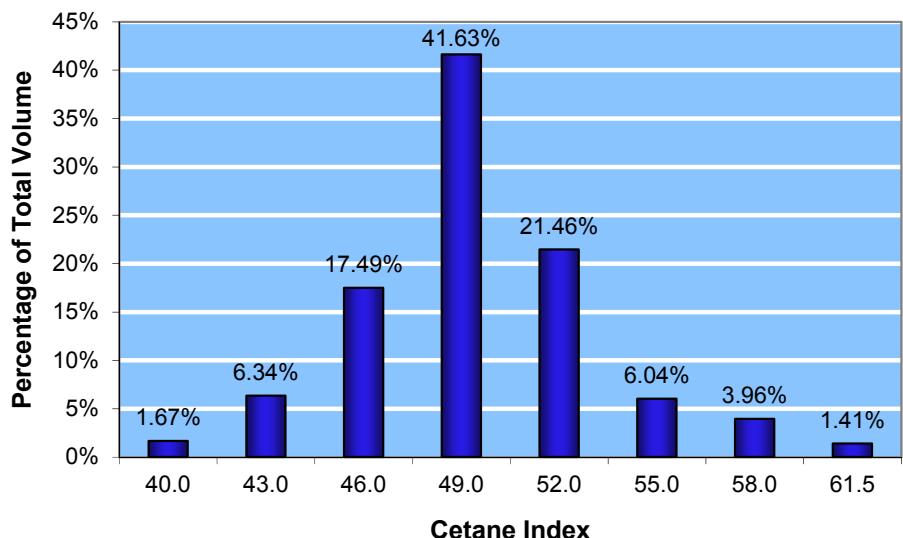


Figure 8-1: Cetane Index (calculated), minimum 40

**Pour Point—2013**

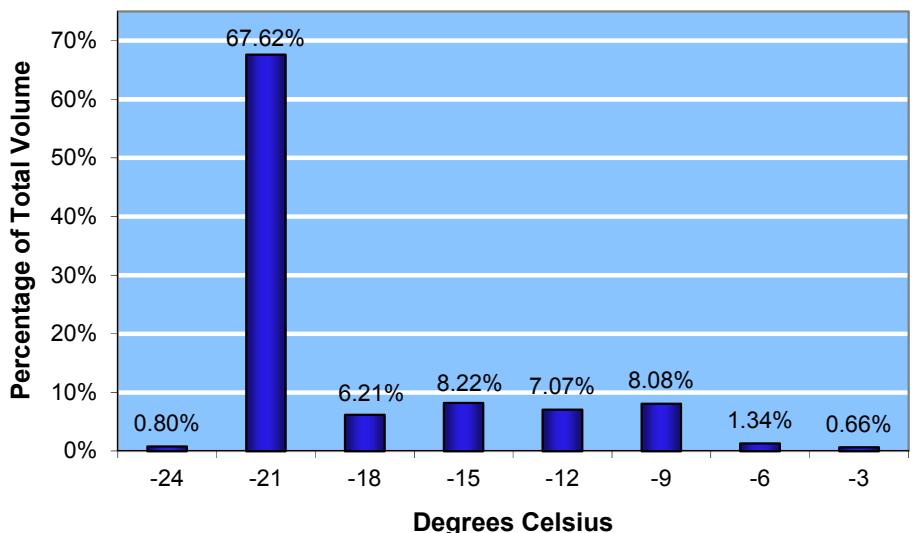


Figure 8-2: Pour Point (°C), maximum -6 (winter quality) or 0 (summer quality)

### Flash Point—2013

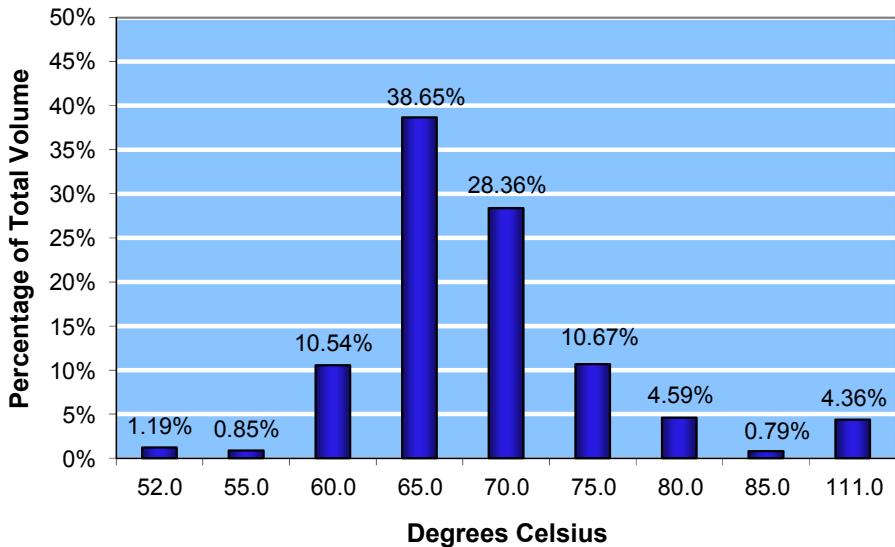


Figure 8-3: Flash Point (°C), minimum 60

### Flash Point 13-Year Trend—Weighted Mean

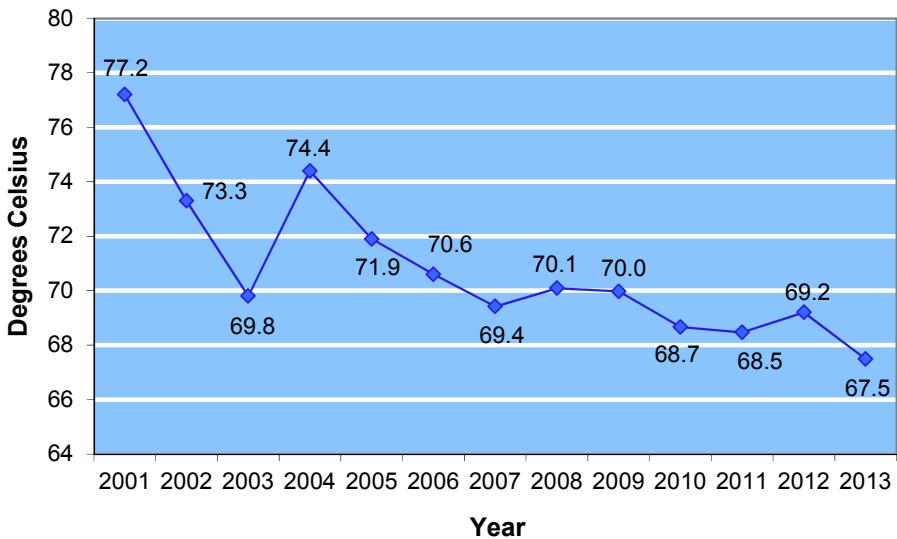


Figure 8-4: Flash Point (°C), 13-Year Trend, minimum 60

## 8. MGO Data

### Kinematic Viscosity—2013

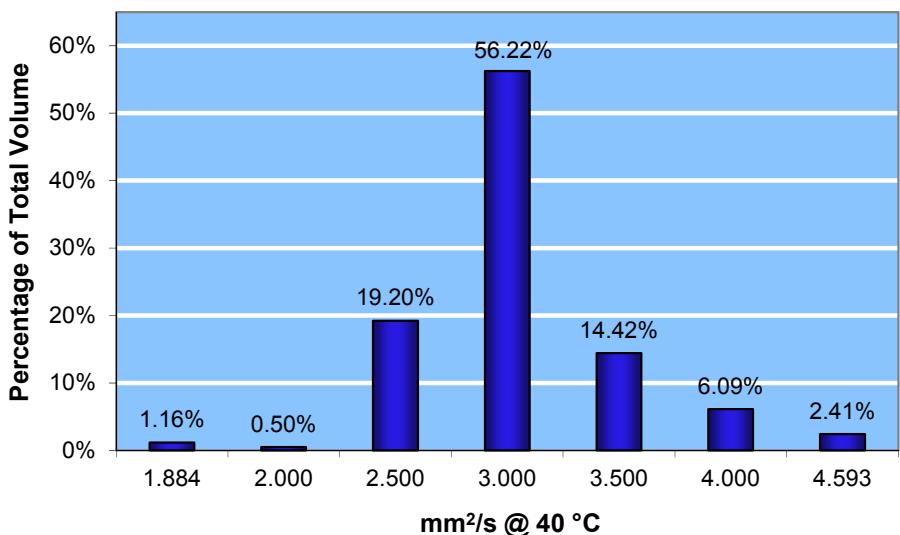


Figure 8-5: Kinematic Viscosity (mm<sup>2</sup>/s @ 40 °C), minimum 2.000, maximum 6.000

### Kinematic Viscosity 13-Year Trend—Weighted Mean

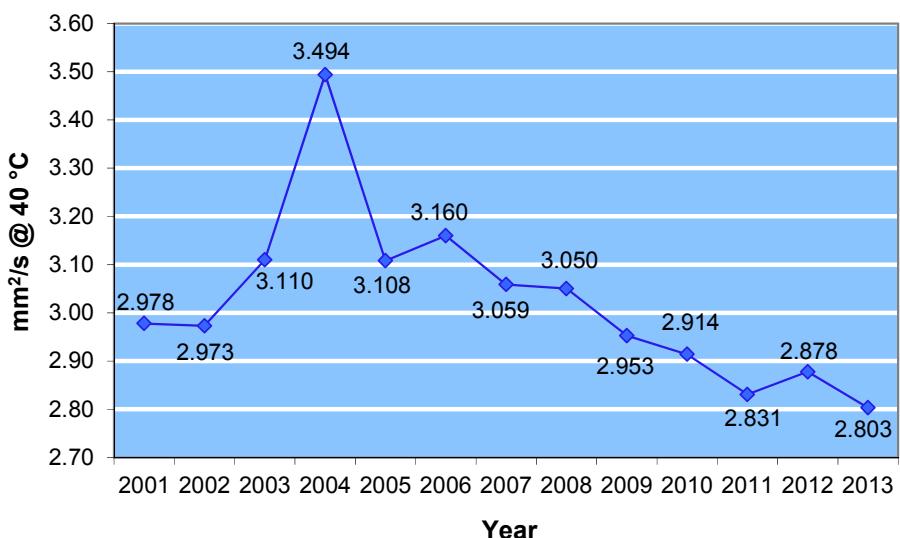


Figure 8-6: Kinematic Viscosity (mm<sup>2</sup>/s @ 40 °C), 13-Year Trend, minimum 2.000, maximum 6.000

### Density—2013

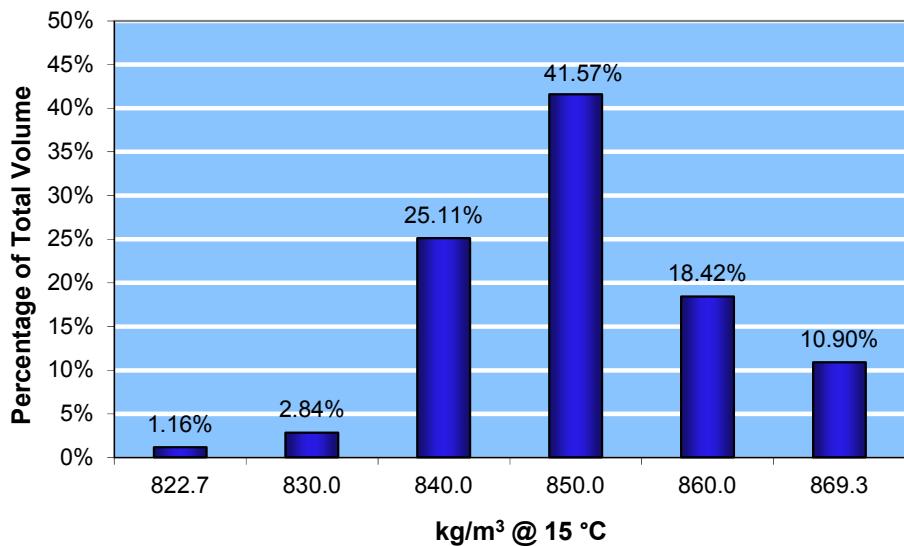


Figure 8-7: Density (kg/m<sup>3</sup> @ 15 °C), maximum 890

### Density 13-Year Trend—Weighted Mean

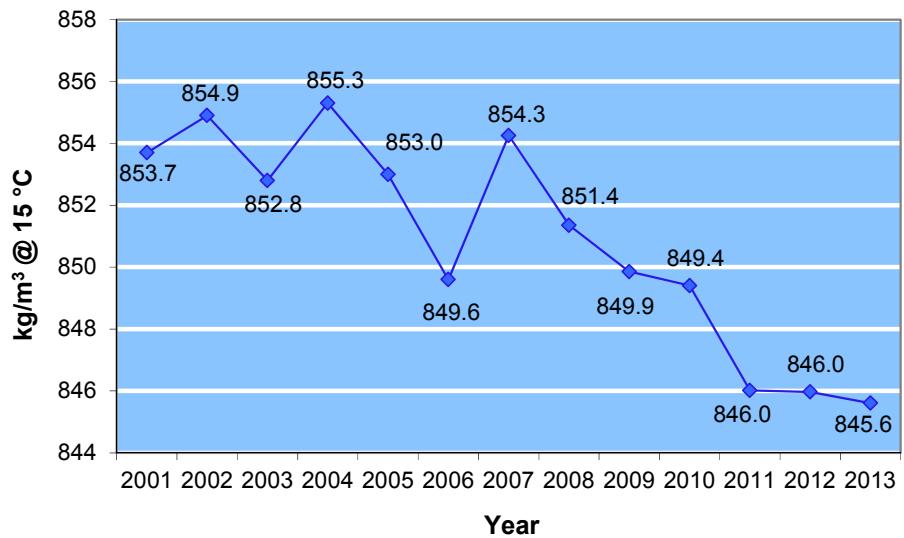


Figure 8-8: Density (kg/m<sup>3</sup> @ 15 °C), 13-Year Trend, maximum 890

## 8. MGO Data

### Carbon Residue (10% Bottoms), ASTM D4530—2013

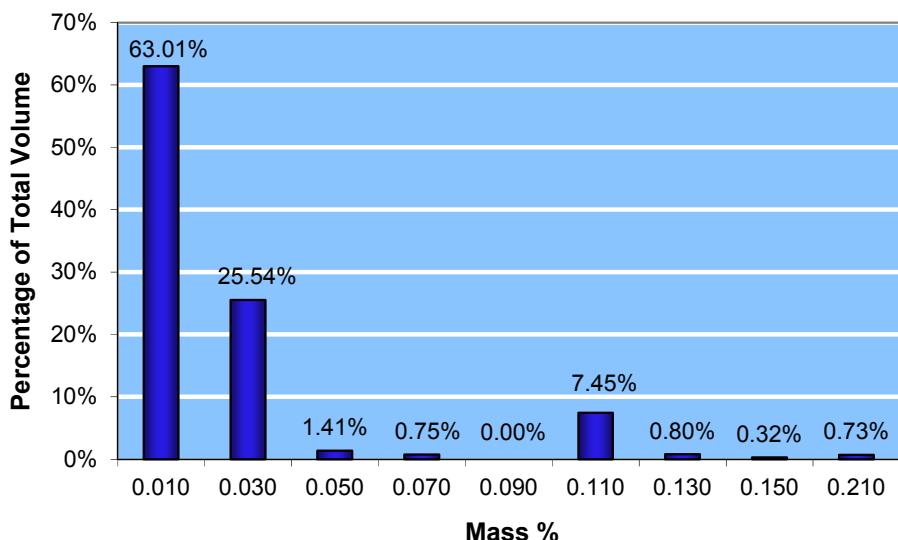


Figure 8-9: Carbon Residue (10% Bottoms), D-4530 (mass %), maximum 0.30

### Carbon Residue (10% Bottoms), ASTM D4530 10-Year Trend—Weighted Mean

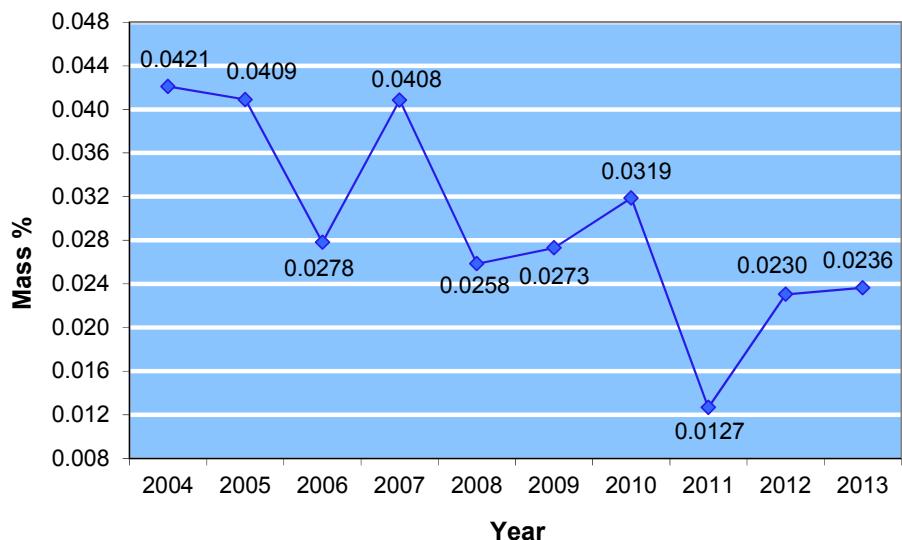


Figure 8-10: Carbon Residue (10% Bottoms), D-4530 (mass %), 10-Year Trend, maximum 0.30

## Sulfur—2013

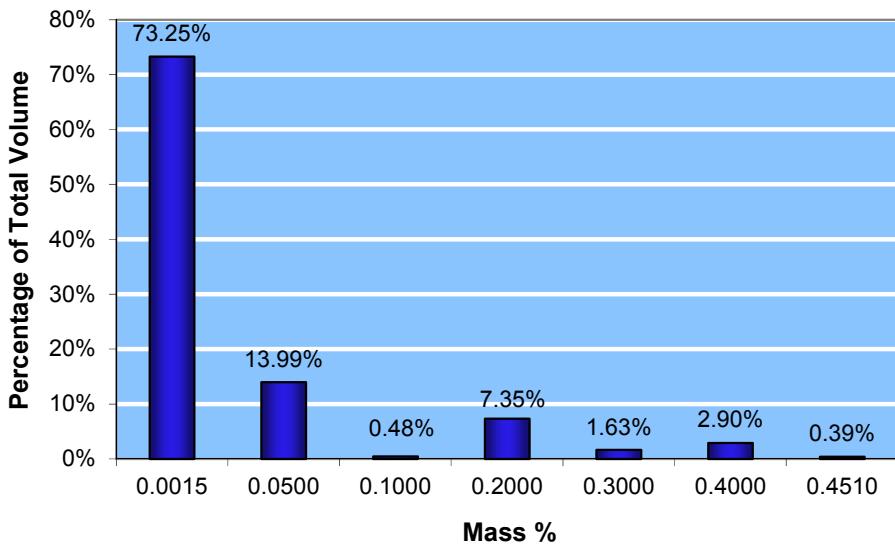


Figure 8-11: Sulfur (mass %), maximum 1.0

## Sulfur 13-Year Trend—Weighted Mean

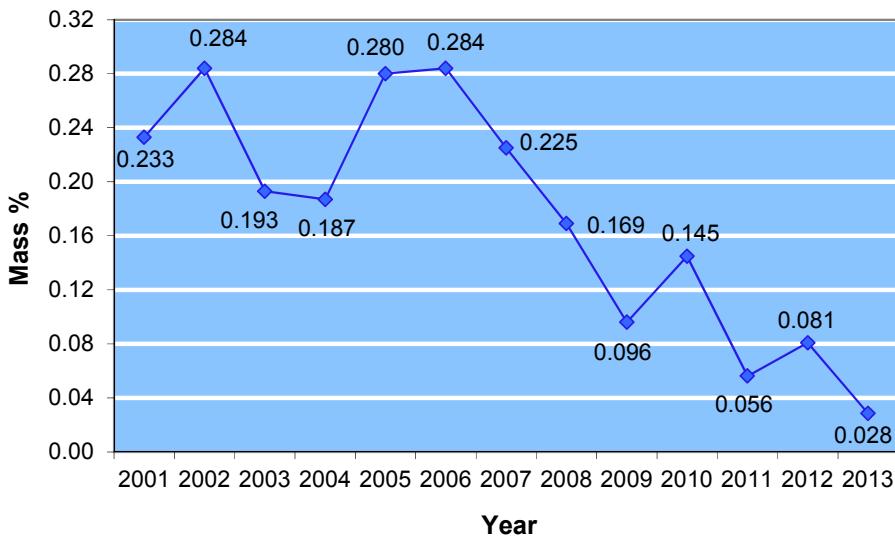


Figure 8-12: Sulfur (mass %), 13-Year Trend, maximum 1.0

**Note:** Per commercial MGO minimum specification requirements (DLA Energy, October 2010), the sulfur maximum limit is 1.0 mass percent.

## 8. MGO Data

Ash—2013

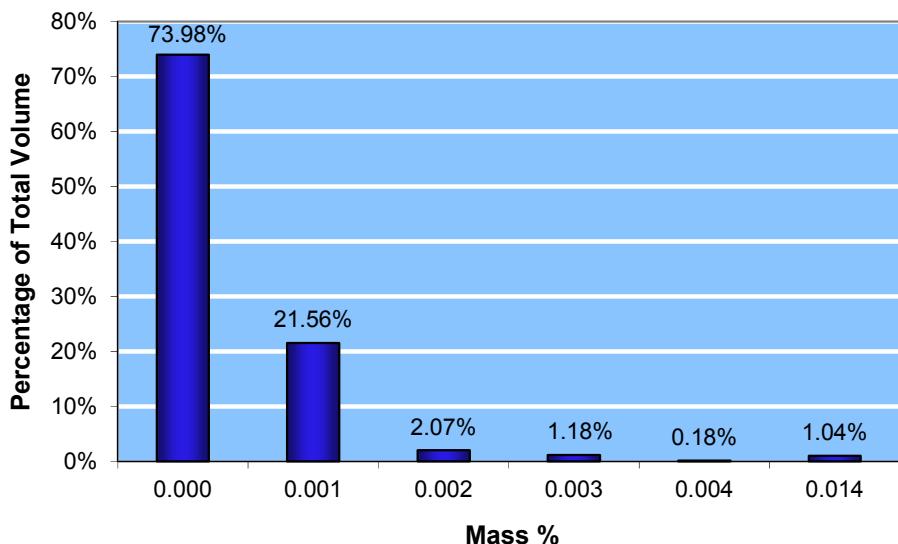


Figure 8-13: Ash (mass %), maximum 0.010

Acid Number—2013

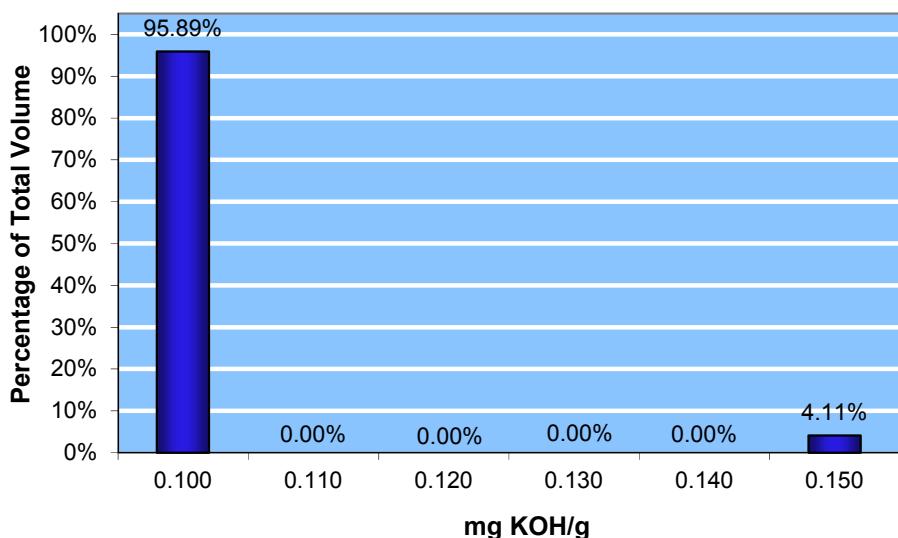


Figure 8-14: Acid Number (mg KOH/g), maximum 0.5

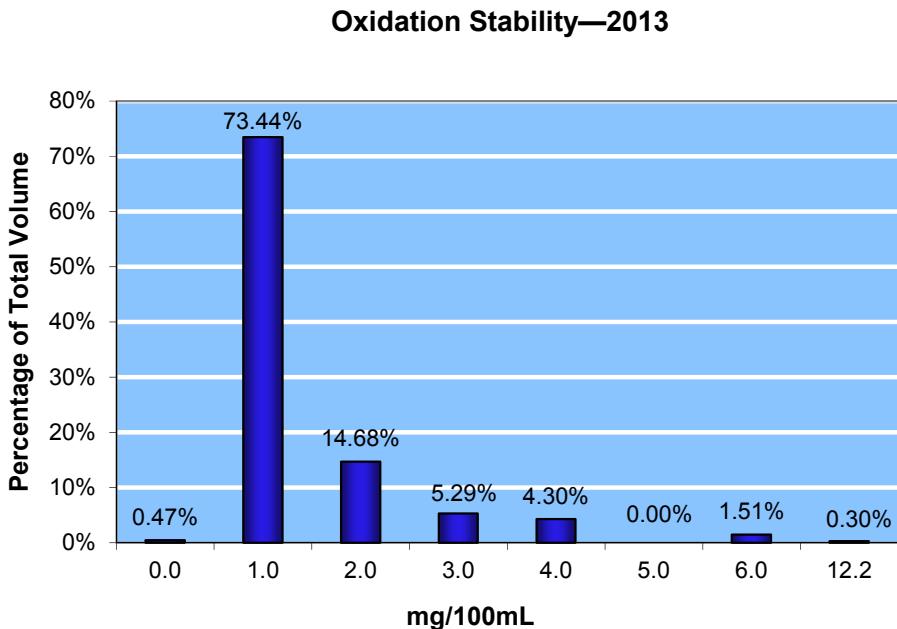


Figure 8-15: Oxidation Stability (g/m<sup>3</sup>), maximum 25

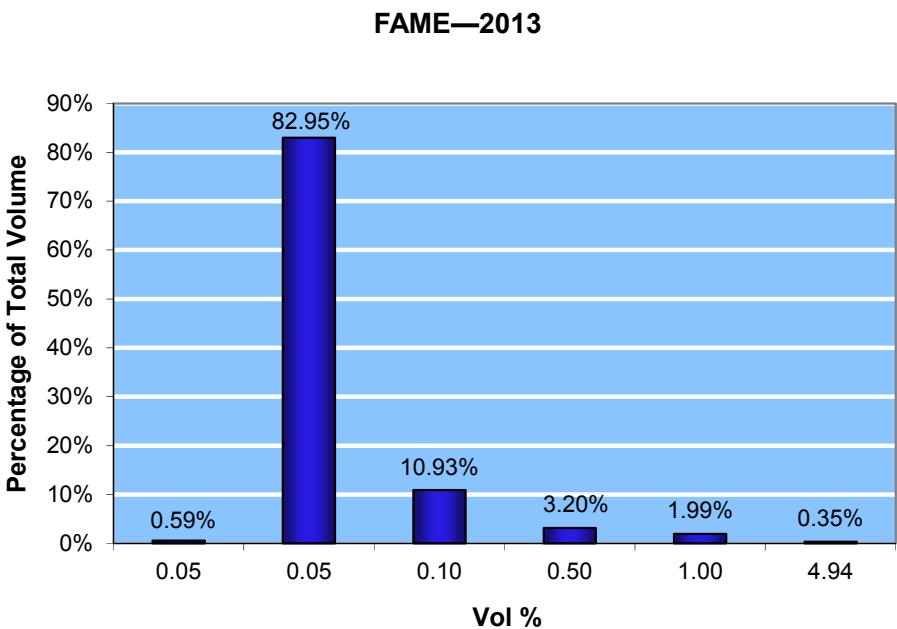


Figure 8-16: FAME (vol %), maximum 0.5

**Note:** The ISO-8217 Grade DMA requirements specify a 0.1 volume percent maximum limit for FAME. The DLA Energy MGO clause has raised the maximum allowable contamination to 0.5 volume percent as a result of a Navy test program.

## 8. MGO Data

### Lubricity—2013

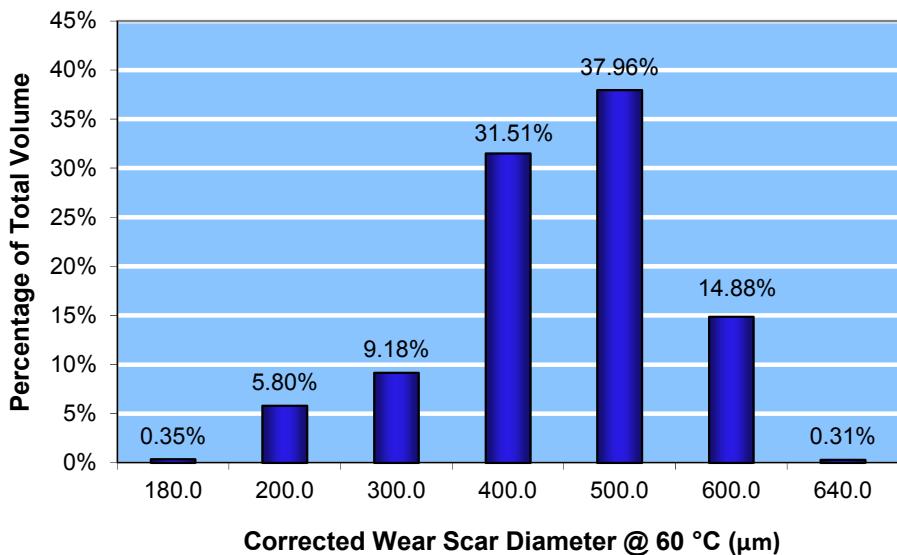


Figure 8-17: Lubricity, corrected wear scar diameter @ 60 °C (µm), maximum 520

### Lubricity 4-Year Trend—Weighted Mean

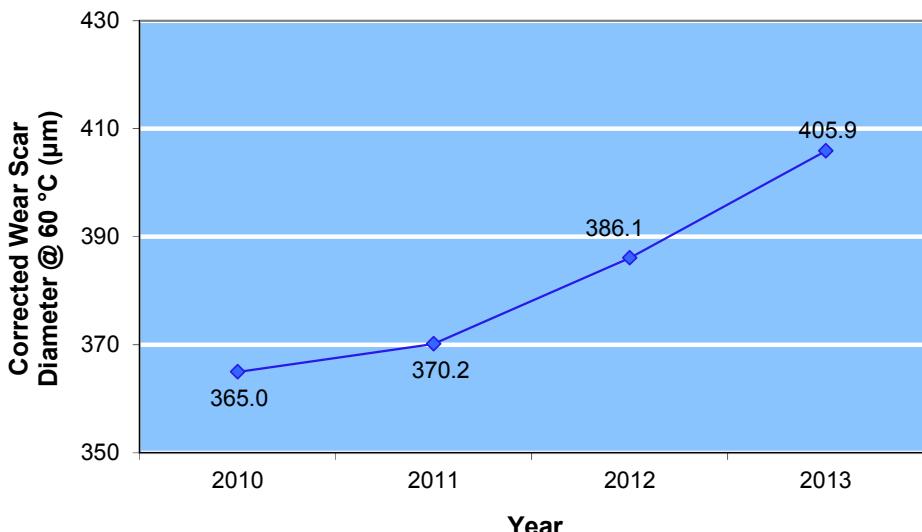


Figure 8-18: Lubricity, corrected wear scar diameter @ 60 °C (µm), 4-Year Trend, maximum 520

**Note:** The lubricity requirement is applicable to fuels with sulfur content below 0.050 mass percent.

### Cloud Point—2013

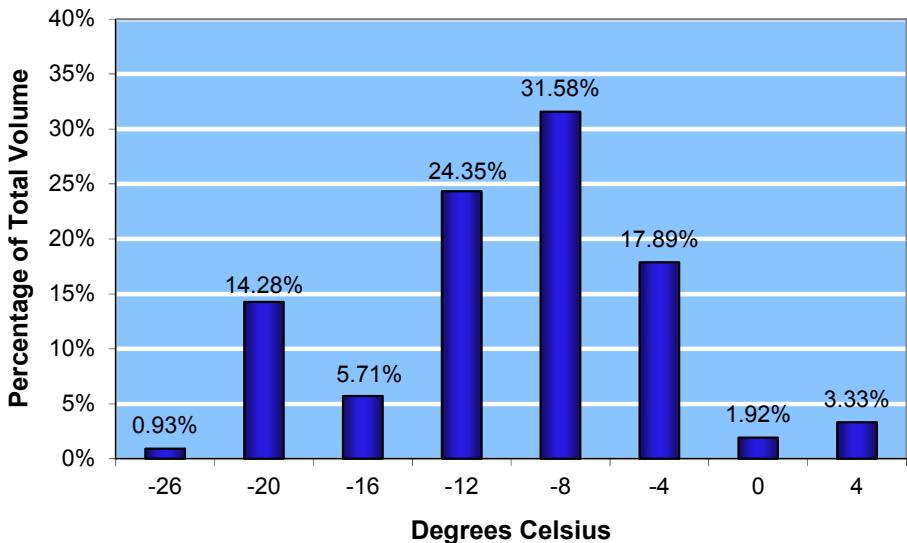


Figure 8-19: Cloud Point (°C), Report

### Particulate Contamination—2013

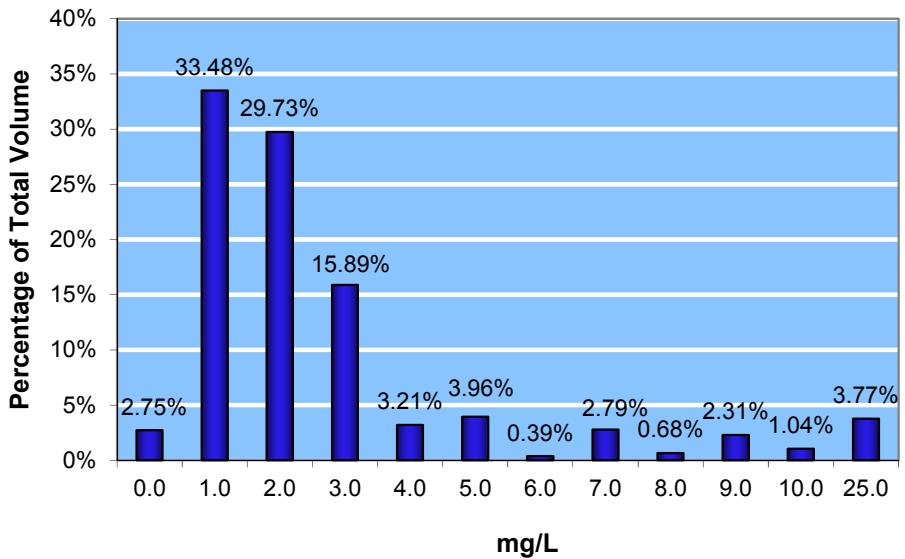


Figure 8-20: Particulate Contamination (mg/L), Report

## 8. MGO—In-Line Sampling Program

### Overview:

A total of 143 samples were processed through the Coast Guard In-Line Sampling Program in 2013. The majority of these samples included test measurement values for a wide range of fuel characteristics. Table 8-10 provides a summary of the number of test measurements for each fuel property.

Number of Test Measurements	Fuel Property
143	Density (@ 15 °C), Flash Point, Kinematic Viscosity (@ 40 °C), and FAME
142	Appearance, Ash, Acid Number, Pour Point, Carbon Residue (test method D-4530), and Lubricity
138	Distillation 90% Point, Distillation End Point, Distillation Residue + Loss, and Cetane Index
137	Cloud Point, Copper Corrosion (@ 100 °C), Demulsification (@ 25 °C), Storage (Oxidation) Stability, Calcium, Lead, and Vanadium
136	Sulfur and Particulate Contamination
132	Sodium + Potassium
54	Color

Table 8-10: Number of Fuel Property Test Measurements for MGO, CY 2013

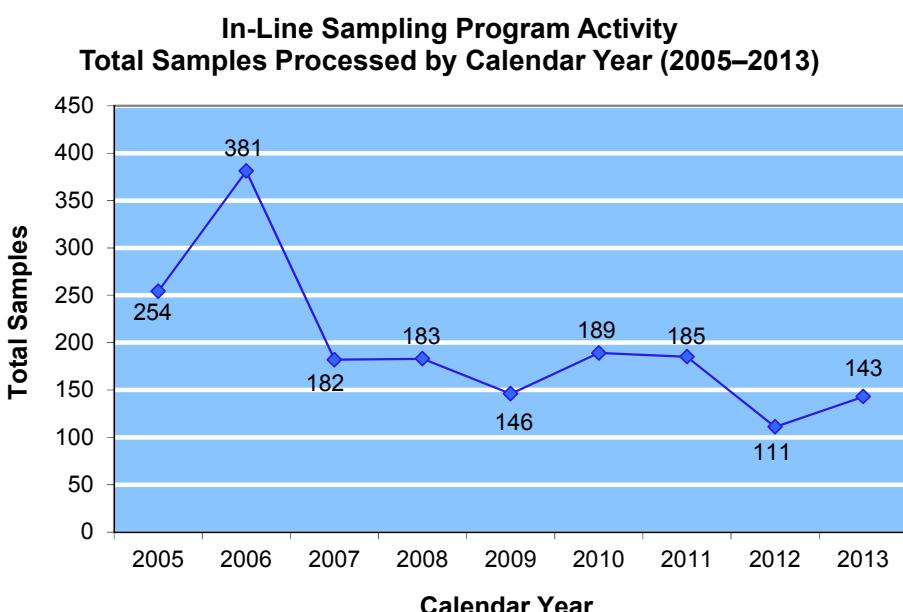


Figure 8-21: In-Line Sampling Program Activity, Total Samples Processed by Calendar year (2005-2013)

## 8. MGO—In-Line Sampling Program

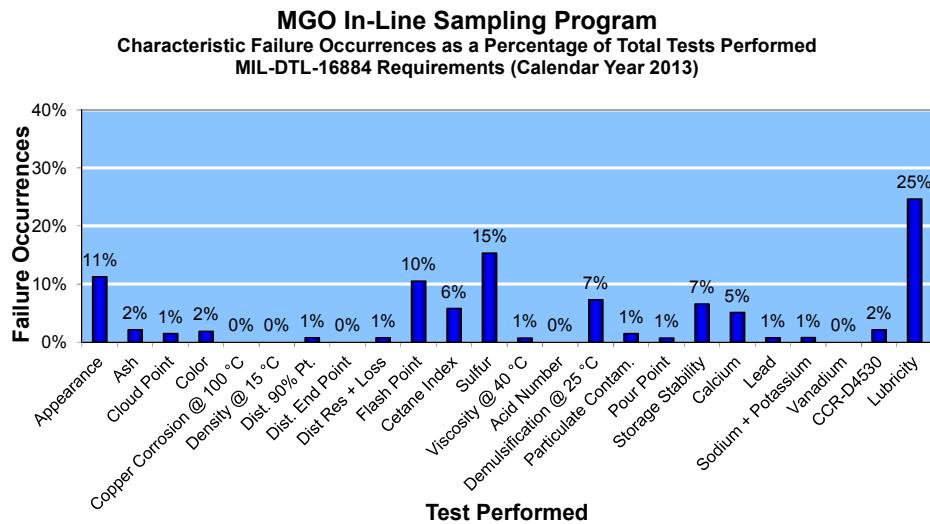


Figure 8-22: MGO In-Line Sampling Program, Percentage of Failure Occurrences, MIL-DTL-16884 Requirements, CY 2013

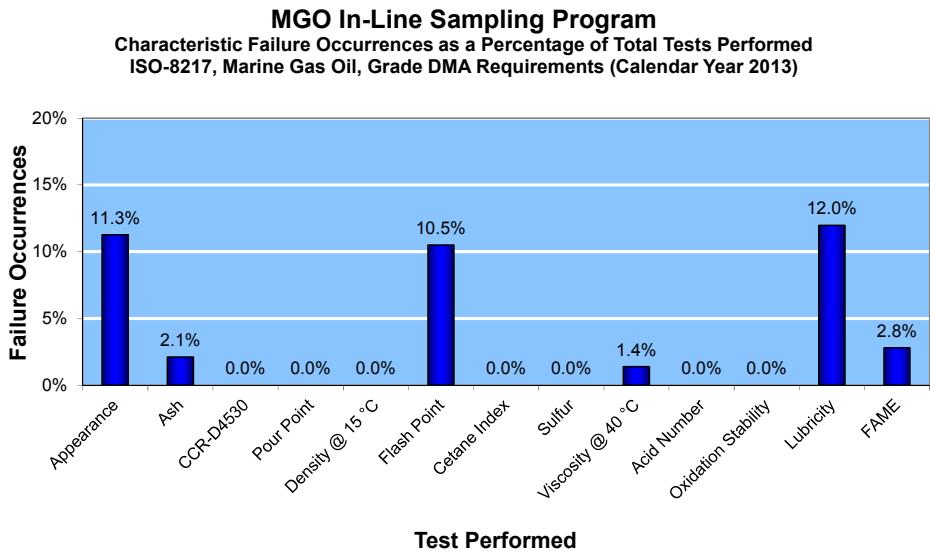
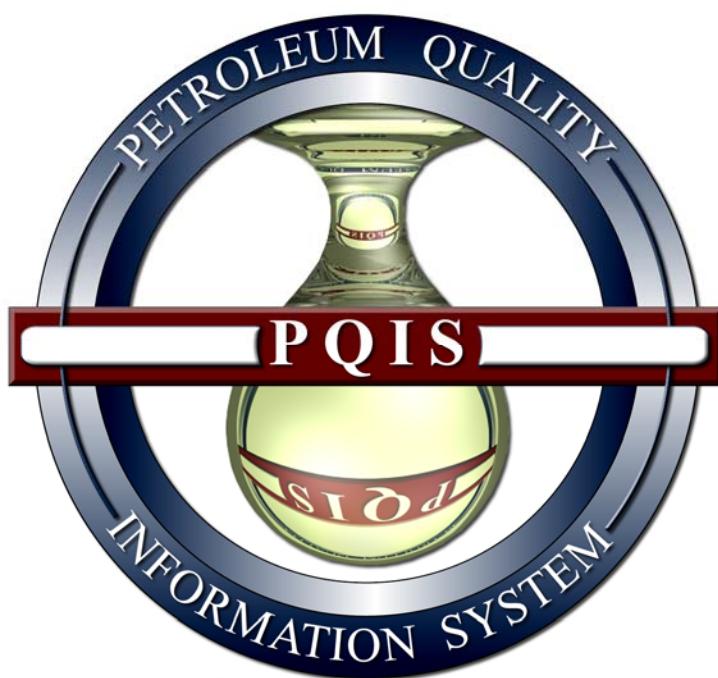


Figure 8-23: MGO In-Line Sampling Program, Percentage of Failure Occurrences, ISO-8217, Marine Gas Oil, Grade DMA Requirements, CY 2013

## 8. MGO Data





## 9. TS1–2013 Data Summary

Turbine Fuel, Aviation, TS1 Russian Grade, GOST 10227-86			
Property	2013 Source Inputs		
	Region	Volume	Batch
<b>Density:</b> (kg/m <sup>3</sup> @ 20 °C)	8	NR	64
<b>Fractional Composition (Distillation):</b>			
Overpoint, (°C)	8	NR	65
10% is Distilled Off at Temperature, (°C)	8	NR	65
50% is Distilled Off at Temperature, (°C)	8	NR	65
90% is Distilled Off at Temperature, (°C)	8	NR	65
98% is Distilled Off at Temperature, (°C)	8	NR	65
Distillation Residue, (vol %)	8	NR	22
Distillation Losses, (vol %)	8	NR	22
<b>Kinematic Viscosity:</b>			
mm <sup>2</sup> /s (cSt) @ 20 °C	8	NR	64
mm <sup>2</sup> /s (cSt) @ -40 °C	8	NR	36
mm <sup>2</sup> /s (cSt) @ -20 °C	8	NR	14
<b>Low Heat Value:</b> (kJ/kg)	8	NR	54
<b>Smoke Point:</b> (mm)	8	NR	59
<b>Acidity:</b> (mg KOH/100cm <sup>3</sup> )	8	NR	64
<b>Flash Temperature Determined in the Closed Crucible:</b> (°C)	8	NR	64
<b>Chilling Temperature:</b> (°C)	8	NR	53
<b>Aromatic Hydrocarbons:</b> (mass %)	8	NR	49
<b>Soluble Gum Concentration:</b> (mg/100cm <sup>3</sup> )	8	NR	33
<b>Sour Sulfur:</b> (mass %)	8	NR	61
<b>Total Sulfur:</b> (mass %)	8	NR	64
<b>Ash Level:</b> (mass %)	8	NR	NR
<b>Iodine Number:</b> (g iodine/100 g of fuel)	8	NR	63
<b>Thermo-Oxidative Stability in Static Conditions, Residue Concentration:</b> (mg/100cm <sup>3</sup> at 150 °C)	8	NR	37

Table 9-1: Data Summary, Turbine Fuel, Aviation, TS1 Russian Grade, GOST 10227-86, 2013 Source Inputs

## 9. TSI—2013 Data Summary

Turbine Fuel, Aviation, TS1 Russian Grade, GOST 10227-86					
Property	Specification Limits (TC-1, First Grade)		2013 Test Results		
	Min	Max	Min	Max	Mean
<b>Density:</b> (kg/m <sup>3</sup> @ 20 °C)	775		783.7	799.6	792.0
<b>Fractional Composition (Distillation):</b>					
Overpoint, (°C)		150	135.0	146.6	141.7
10% is Distilled Off at Temperature, (°C)		165	152.0	170.0	159.7
50% is Distilled Off at Temperature, (°C)		195	173.0	200.0	184.3
90% is Distilled Off at Temperature, (°C)		230	204.0	235.0	216.5
98% is Distilled Off at Temperature, (°C)		250	214.9	256.0	235.5
Distillation Residue, (vol %)		1.5	0.5	1.5	1.0
Distillation Losses, (vol %)		1.5	0.0	1.0	0.4
<b>Kinematic Viscosity:</b>					
mm <sup>2</sup> /s (cSt) @ 20 °C	1.25		1.329	1.890	1.459
mm <sup>2</sup> /s (cSt) @ -40 °C		Report	4.908	6.430	5.930
mm <sup>2</sup> /s (cSt) @ -20 °C		8.0	2.870	3.550	3.136
<b>Low Heat Value:</b> (kJ/kg)	42,900		43,208	43,421	43,274
<b>Smoke Point:</b> (mm)	25.0		25.0	27.0	25.7
<b>Acidity:</b> (mg KOH/100cm <sup>3</sup> )		0.7	0.002	0.690	0.266
<b>Flash Temperature Determined in the Closed Crucible:</b> (°C)	28.0		32.0	47.0	36.6
<b>Chilling Temperature:</b> (°C)		-60	-67.5	-49.0	-59.4
<b>Aromatic Hydrocarbons:</b> (mass %)		20	10.0	20.0	14.2
<b>Soluble Gum Concentration:</b> (mg/100cm <sup>3</sup> )		5	2.00	5.00	3.00
<b>Sour Sulfur:</b> (mass %)		0.003	0.0000	0.0020	0.0012
<b>Total Sulfur:</b> (mass %)		0.25	0.0027	0.1500	0.029
<b>Ash Level:</b> (mass %)		0.003	NR	NR	NR
<b>Iodine Number:</b> (g iodine/100 g of fuel)		3.5	0.20	0.80	0.44
<b>Thermo-Oxidative Stability in Static Conditions, Residue Concentration:</b> (mg/100cm <sup>3</sup> at 150 °C)		18	14.00	17.00	15.70

Table 9-2: Data Summary, Turbine Fuel, Aviation, TS1 Russian Grade, GOST 10227-86, 2013 Test Results

## 9. TS1—Assessment Summary

### ***Overview:***

Turbine Fuel, Aviation, TS1, Russian Grade, was a newly featured product reported for the 2006 procurement year. Due to a lack of reporting, TS1 was not included in the 2008 and 2009 PQIS annual reports, but it was once again incorporated in the 2010 through 2012 reports. For the 2013 procurement year, 65 batches were reported by Region 8 and recorded in the PQIS. The USSR State Standard Jet Fuels specification, GOST 10277-86, Grade TC-1, First Category of Quality, governs the procurement parameters for TS1 and they are presented accordingly.

The results presented in this chapter in the form of histograms correlate to the minimum and maximum table of specifications consistent with the previously described standard.

TS1 is being supplied in Afghanistan for the operational sustainment of forces committed in the region. TS1 is procured “neat” (containing no additives). Russian additives are not approved for use in U.S. aircraft and equipment. Approved additives may be added downstream as required or appropriate for end use.

Product quantities for TS1 were not recorded in the 2013 procurement year. For this reason, weighted mean results for this product cannot be shown.

### ***TS1 Observations:***

All batches met specification requirements for 2013.

Although some distillation temperatures and one chilling temperature fell outside of the specification limits, waivers have been issued throughout the year to accept Jet A-1 specification fuel in lieu of TS1 at certain locations. In addition, DLA Energy has accepted RT (PT in Russian) grade fuel for some locations. Distillation point values and the chilling temperature value above the maximum specification limits are all covered under waivers.

When reading the histograms for TS1, the far left bar represents the percentage of analyses associated with the minimum data value. Any other bar represents the percentage of analyses greater than the data value of the bar to the immediate left of it, up to and including the value of that bar.

### Density @ 20 °C—2013

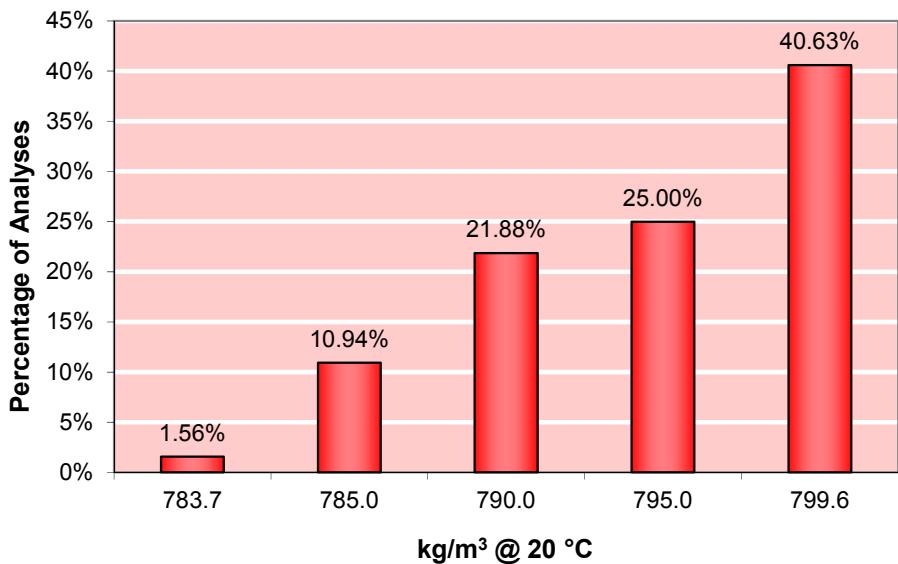


Figure 9-1: Density (kg/m<sup>3</sup> @ 20 °C), minimum 775

### Overpoint—2013

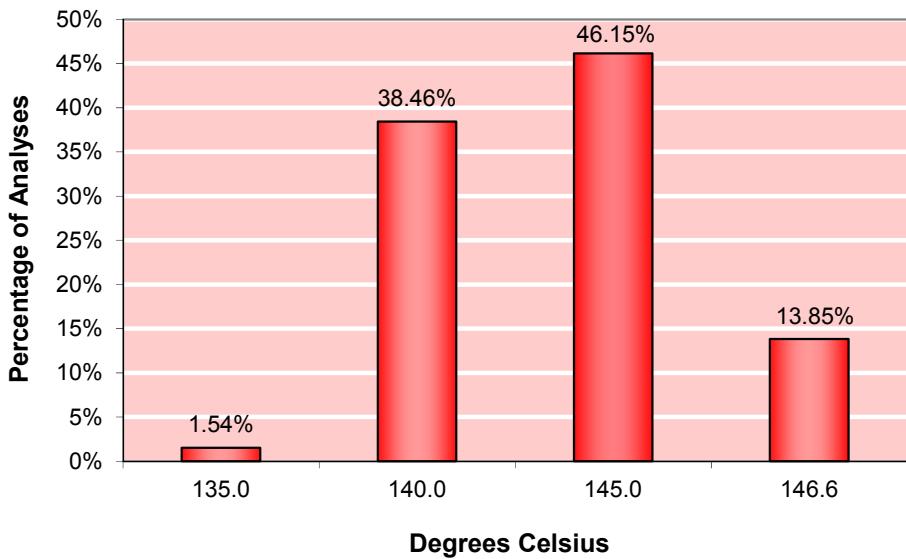


Figure 9-2: Fractional Composition (Distillation), Overpoint (°C), maximum 150

## 9. TS1 Data

### 10% Is Distilled Off at Temperature—2013

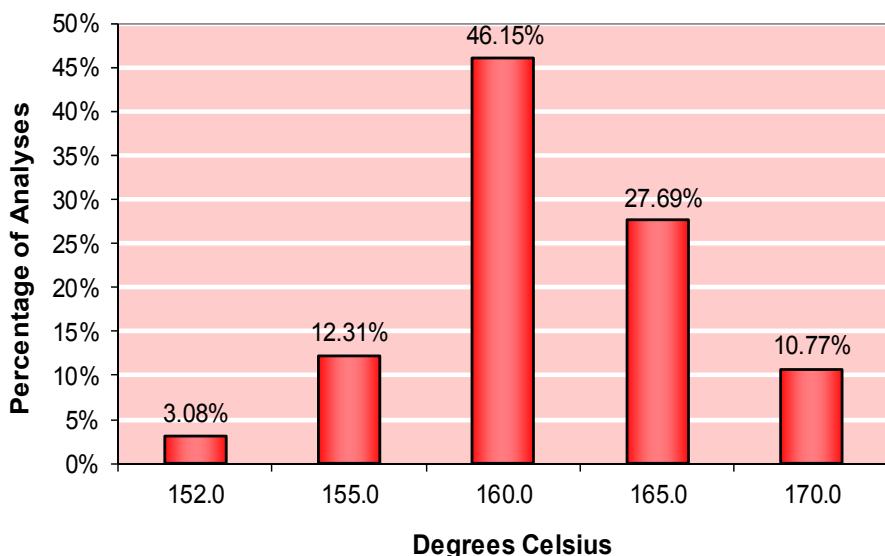


Figure 9-3: Fractional Composition (Distillation), 10% Is Distilled Off at Temperature (°C), maximum 165

### 50% Is Distilled Off at Temperature—2013

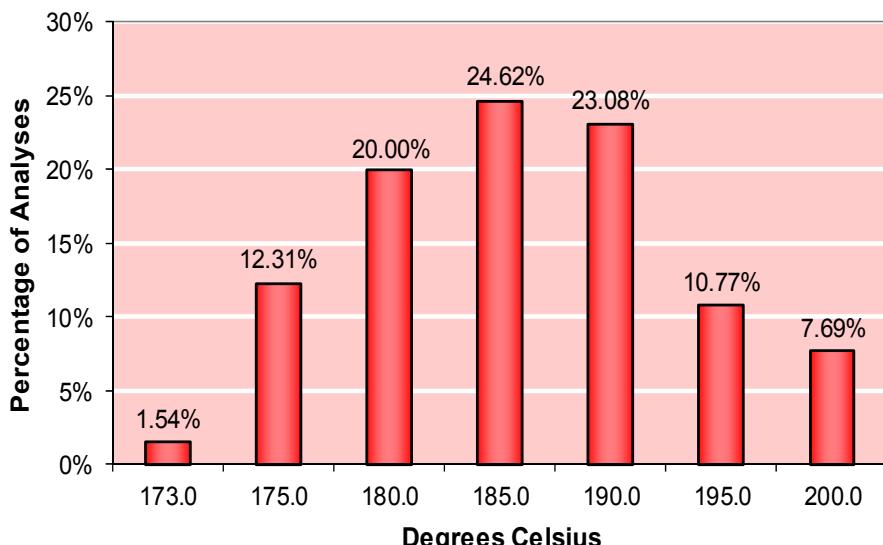


Figure 9-4: Fractional Composition (Distillation), 50% Is Distilled Off at Temperature (°C), maximum 195

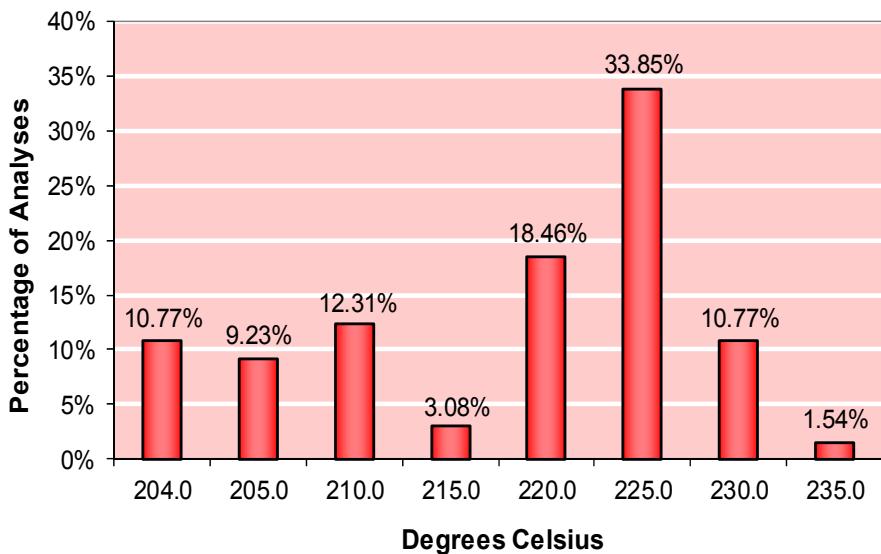
**90% Is Distilled Off at Temperature—2013**

Figure 9-5: Fractional Composition (Distillation), 90% Is Distilled Off at Temperature (°C), maximum 230

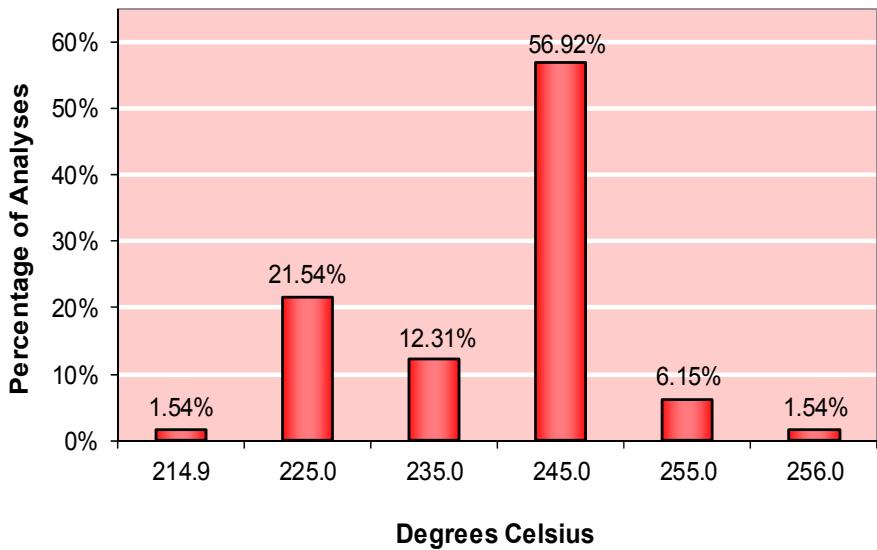
**98% Is Distilled Off at Temperature—2013**

Figure 9-6: Fractional Composition (Distillation), 98% Is Distilled Off at Temperature (°C), maximum 250

## 9. TS1 Data

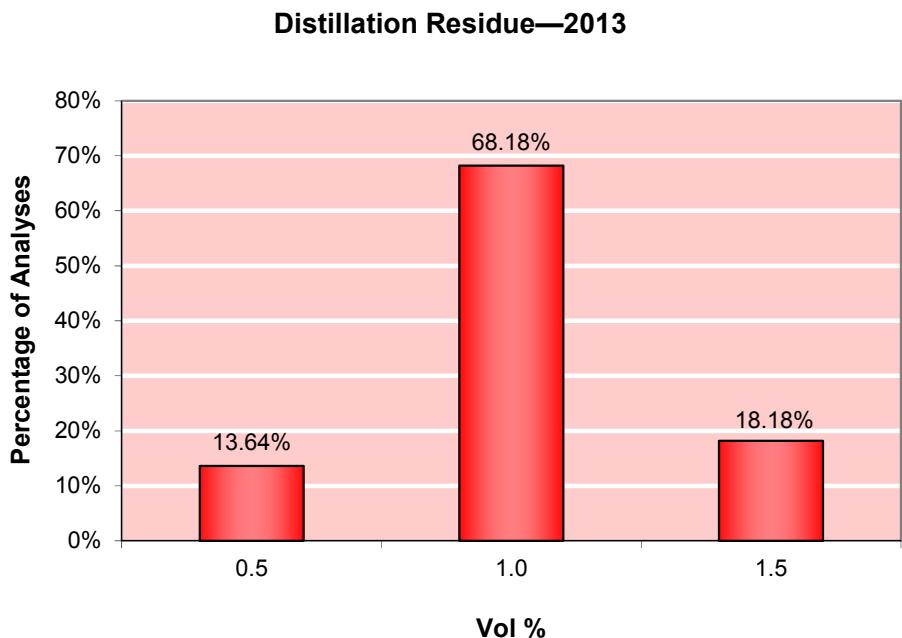


Figure 9-7: Fractional Composition (Distillation), Residue (vol %), maximum 1.5

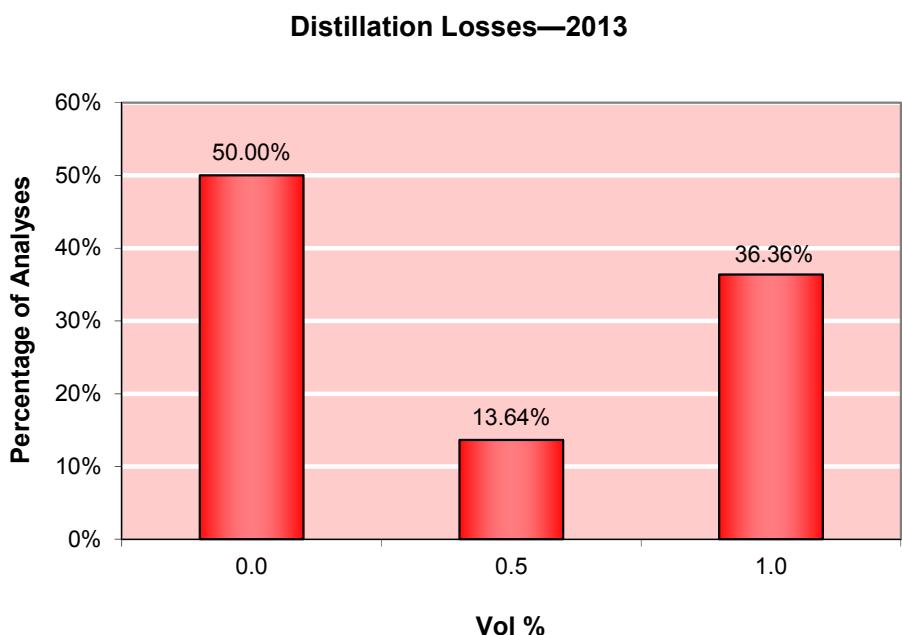
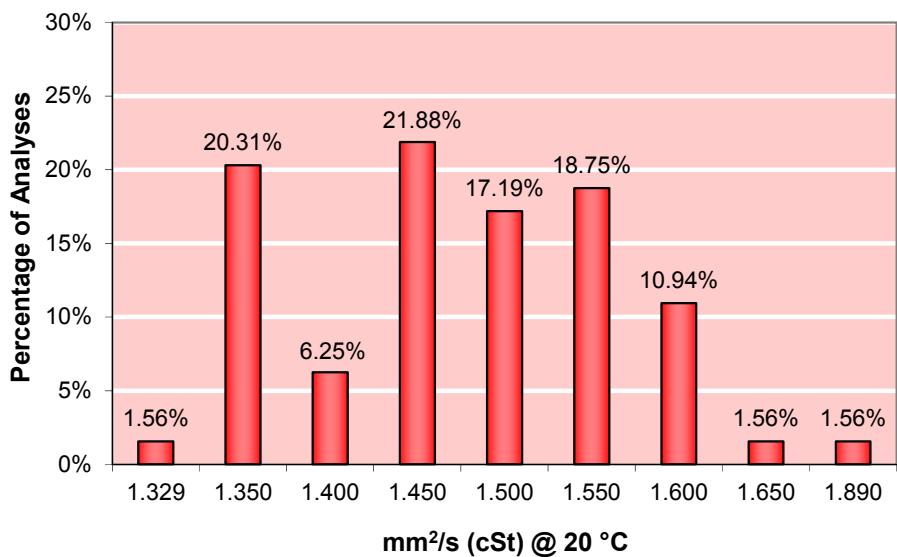
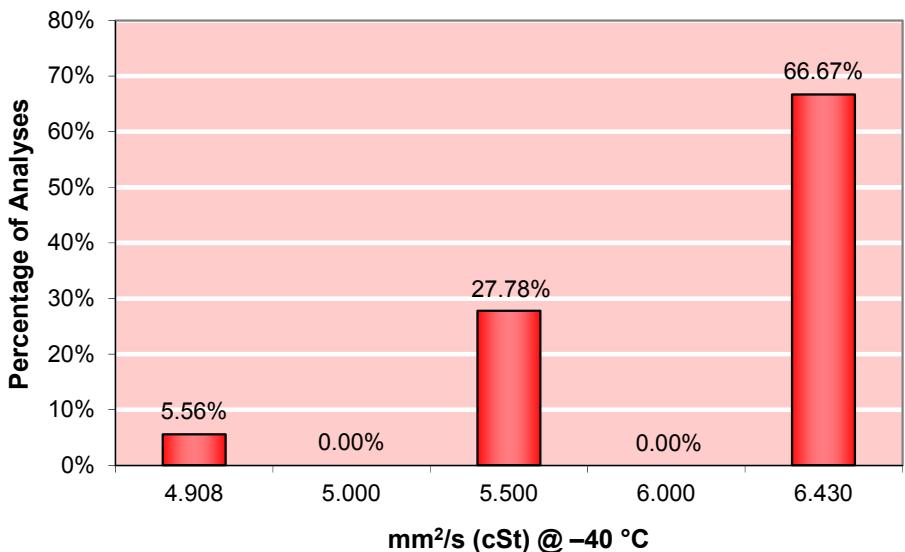


Figure 9-8: Fractional Composition (Distillation), Losses (vol %), maximum 1.5

## Kinematic Viscosity @ 20 °C—2013

Figure 9-9: Kinematic Viscosity (mm<sup>2</sup>/s [cSt] @ 20 °C), minimum 1.25

## Kinematic Viscosity @ -40 °C—2013

Figure 9-10: Kinematic Viscosity (mm<sup>2</sup>/s [cSt] @ -40 °C), Report

## 9. TS1 Data

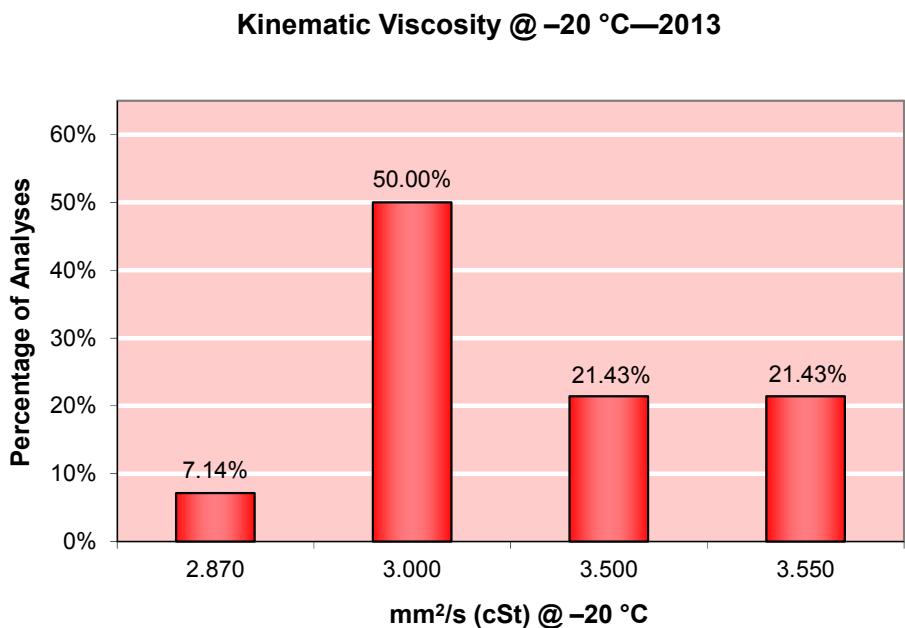


Figure 9-11: Kinematic Viscosity (mm<sup>2</sup>/s [cSt] @ -20 °C), maximum 8.0

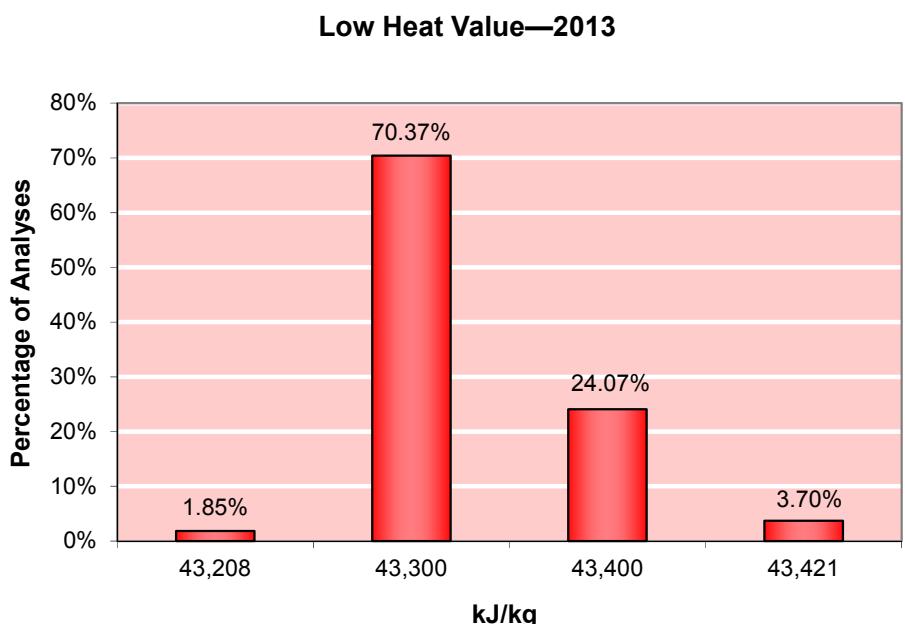


Figure 9-12: Low Heat Value (kJ/kg), minimum 42,900

## Smoke Point—2013

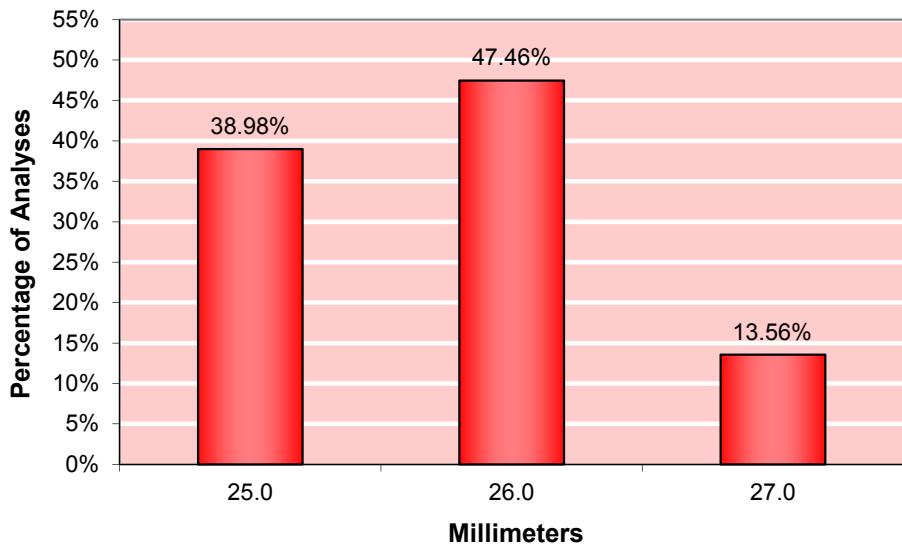
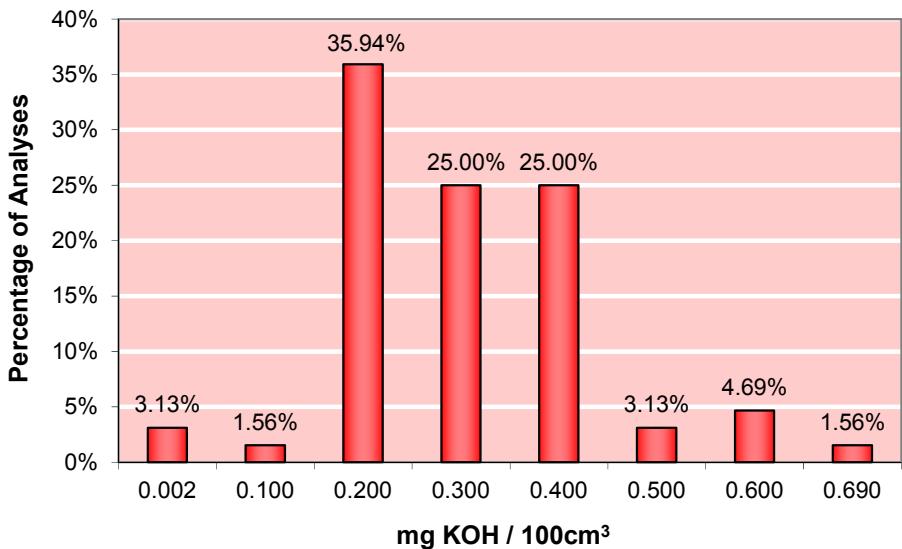


Figure 9-13: Smoke Point (mm), minimum 25.0

## Acidity—2013

Figure 9-14: Acidity (mg KOH/100cm<sup>3</sup>), maximum 0.7

## 9. TS1 Data

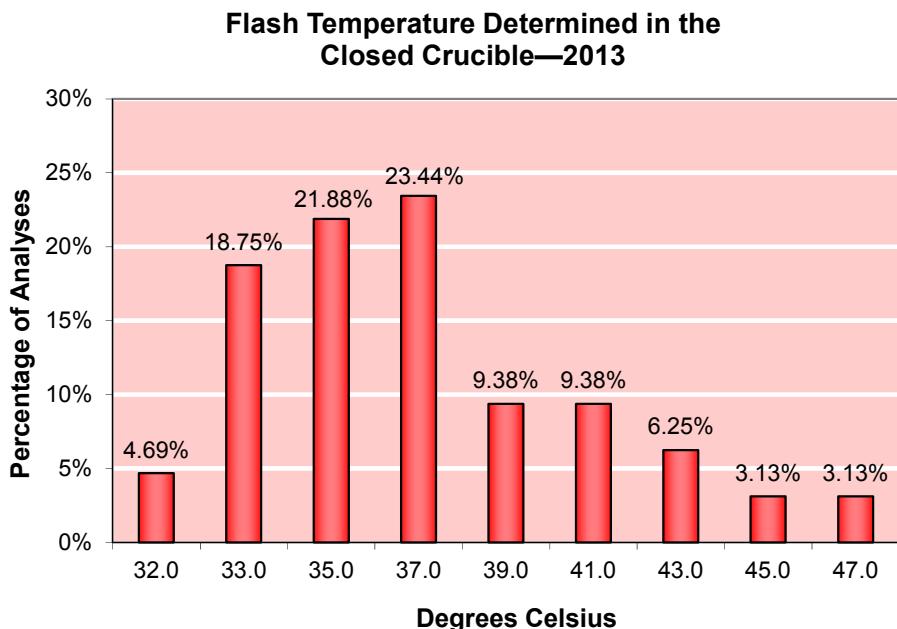


Figure 9-15: Flash Temperature Determined in the Closed Crucible (°C), minimum 28.0

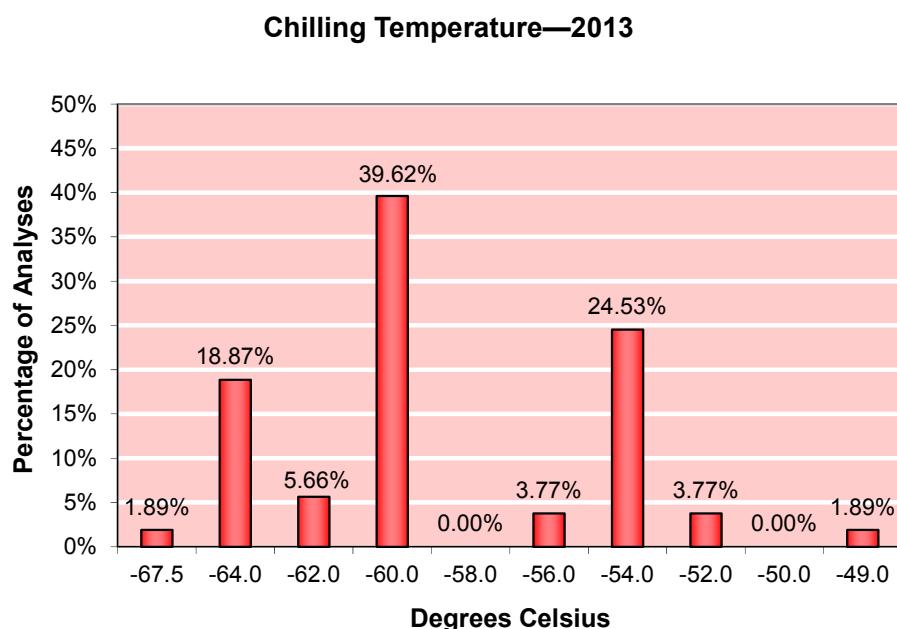


Figure 9-16: Chilling Temperature (°C), maximum -60

## Aromatic Hydrocarbons—2013

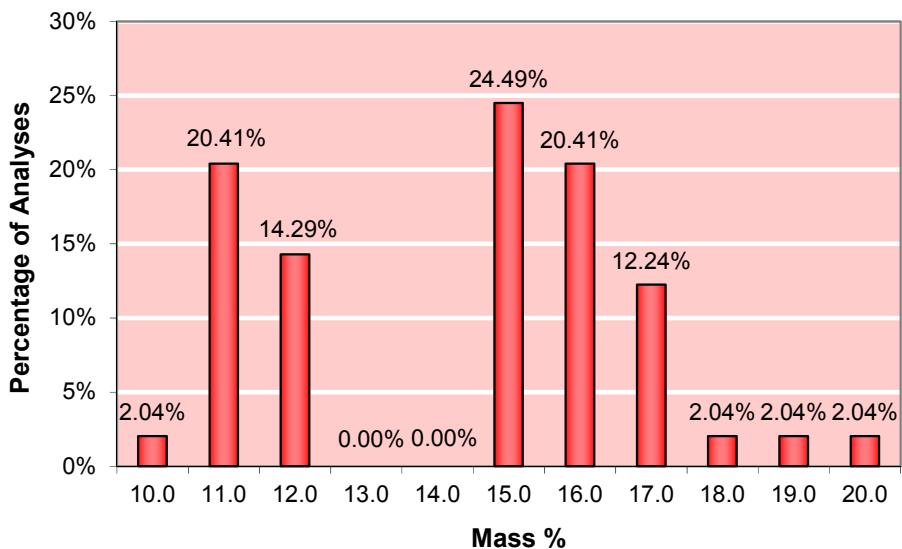
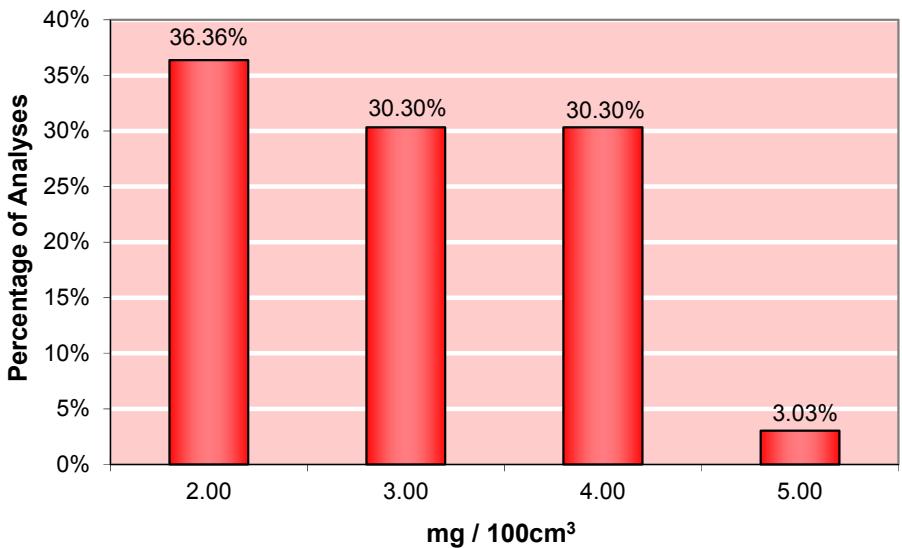


Figure 9-17: Aromatic Hydrocarbons (mass %), maximum 20

## Soluble Gum Concentration—2013

Figure 9-18: Soluble Gum Concentration (mg/100cm<sup>3</sup>), maximum 5

## 9. TS1 Data

Sour Sulfur—2013

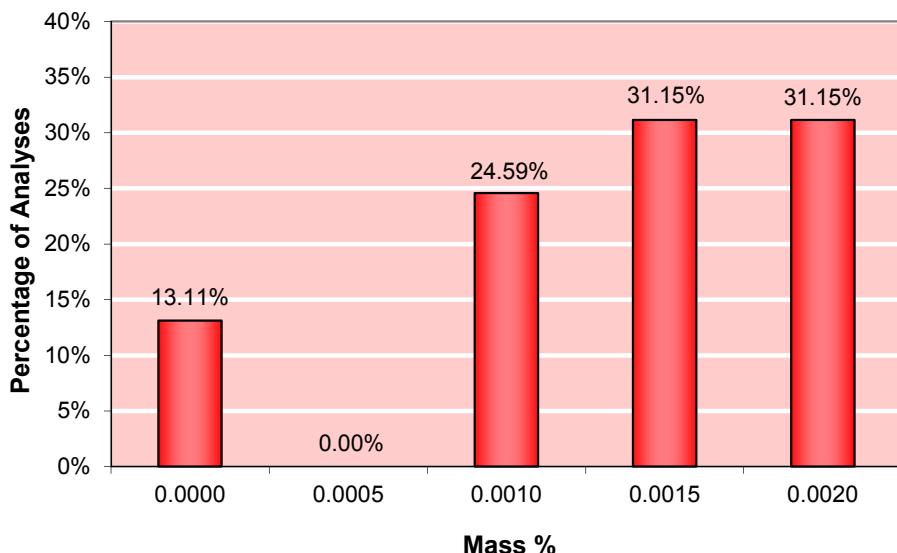


Figure 9-19: Sour Sulfur (mass %), maximum 0.003

Total Sulfur—2013

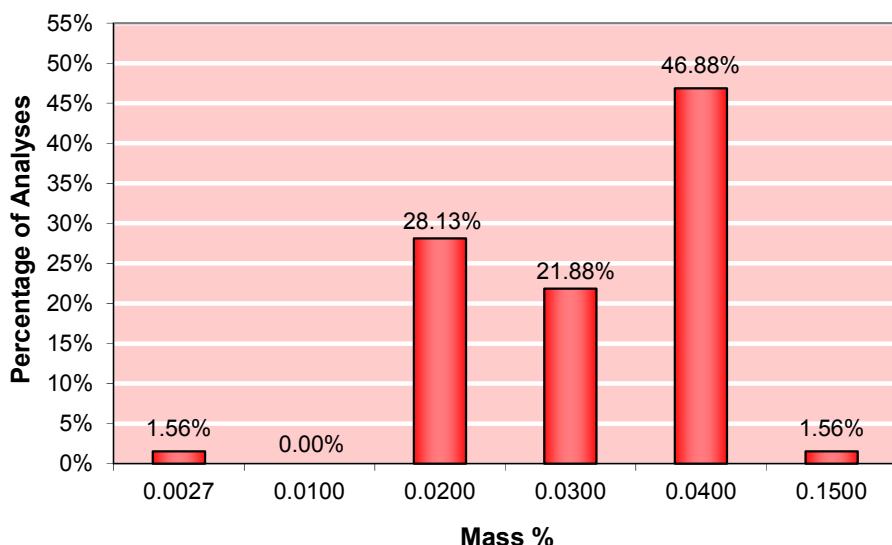


Figure 9-20: Total Sulfur (mass %), maximum 0.25

## Iodine Number—2013

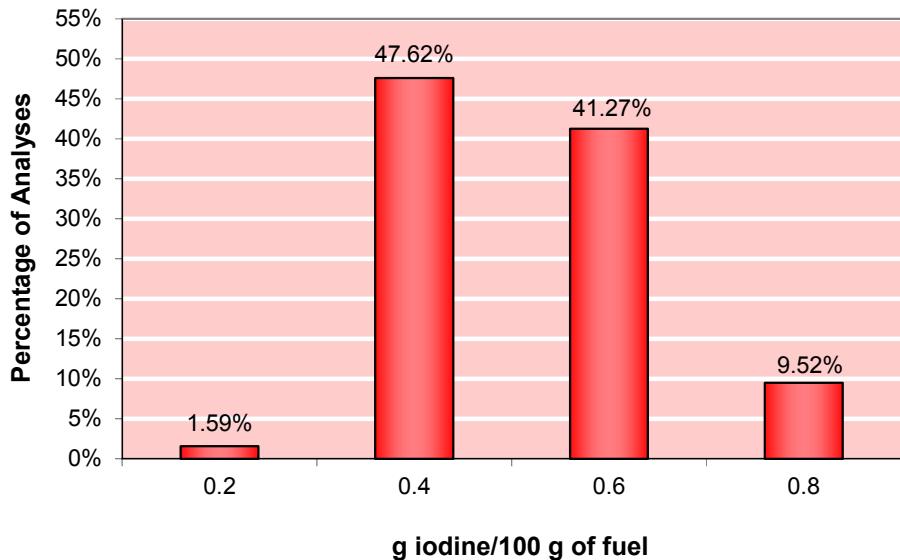


Figure 9-21: Iodine Number (g iodine/100 g of fuel), maximum 3.5

## Thermo-Oxidative Stability in Static Conditions, Residue Concentration—2013

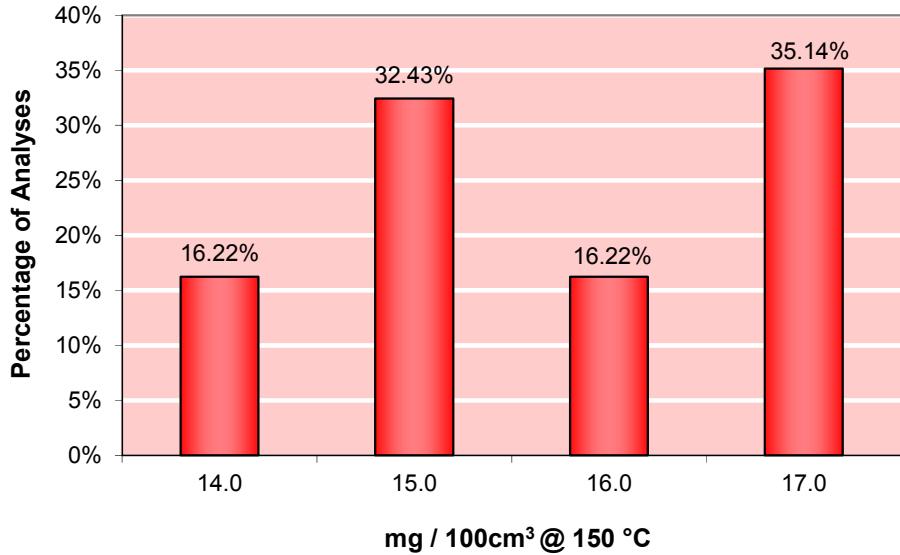
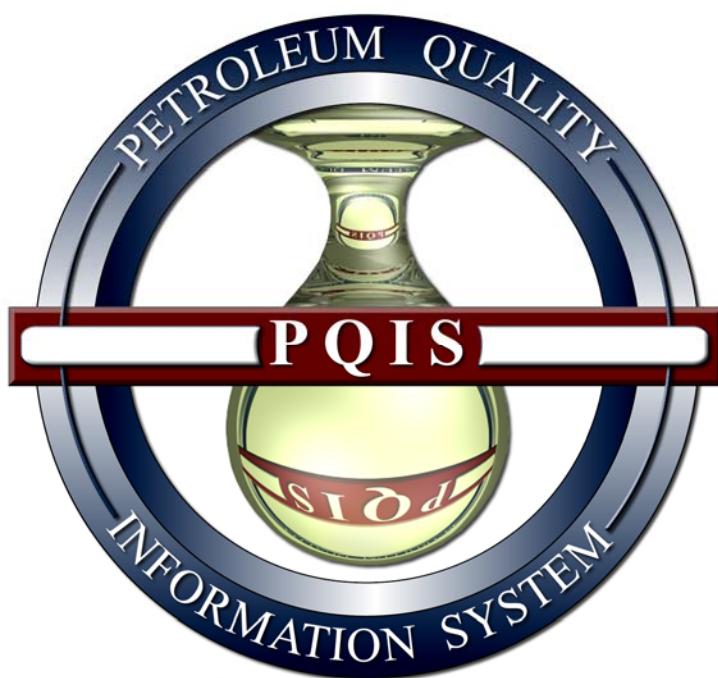
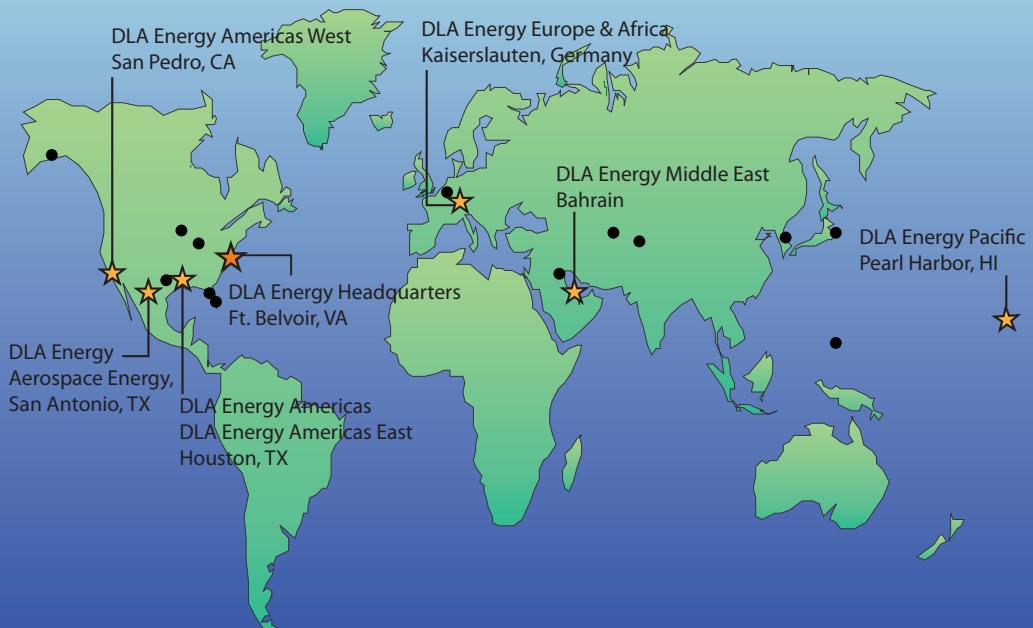


Figure 9-22: Thermo-Oxidative Stability in Static Conditions, Residue Concentration (mg/100cm<sup>3</sup> at 150 °C), maximum 18

## 9. TS1 Data



## DLA ENERGY WORLDWIDE LOCATIONS



Petroleum Quality Information System  
Defense Logistics Agency Energy - DLA Energy FEQB  
8725 John J. Kingman Road  
Ft. Belvoir, VA 22060-6222  
Tel: 703-767-8740 (DSN: 427-8740)  
DLA Energy FEQB email: [pqis@dla.mil](mailto:pqis@dla.mil)

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